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Engineering News-Record

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June 28, 1923

Placing the Sucker Creek Bridge Span: Temiskaming & Northern Ontario Ry.

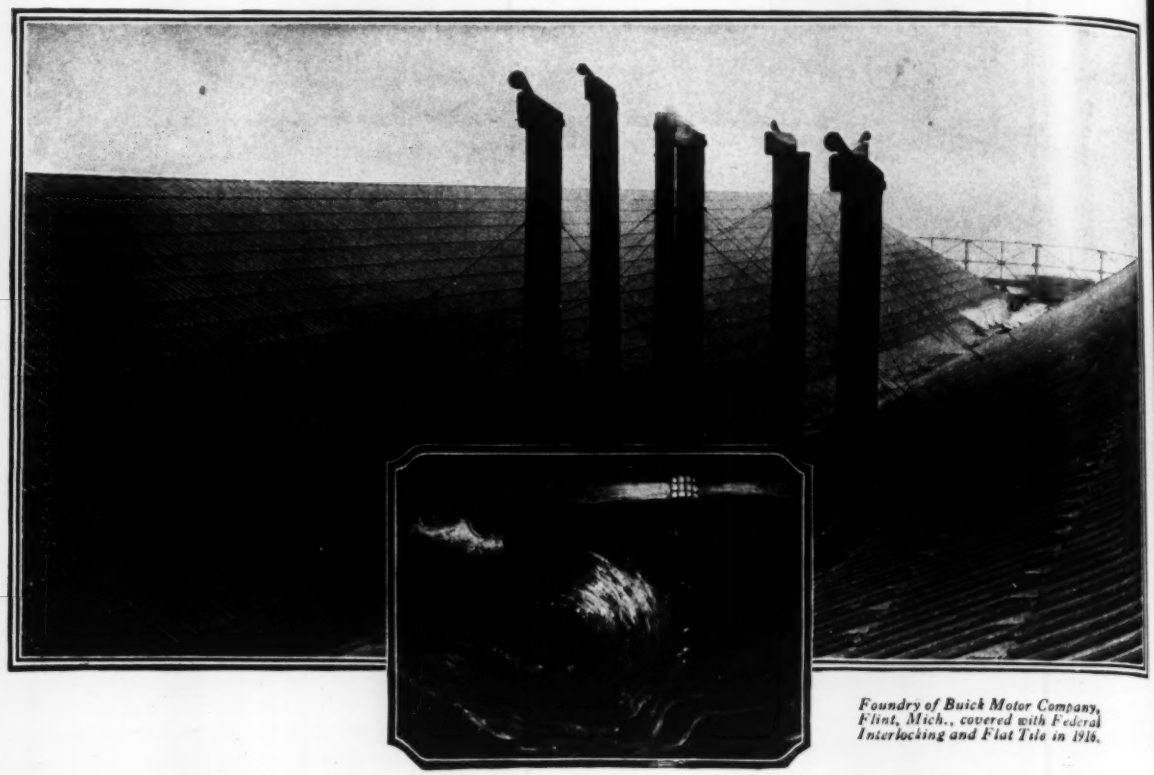
Extending an Ontario Provincial Railway to Hudson Bay

St. Louis Plans Wider Streets to Relieve Traffic Congestion

Report of International Road Congress Conference Held Recently at Seville, Spain

Earth Dam Built by Flooding Dry Fill
By Albert S. Fry

Also Ten Short "Job and Office" Kinks



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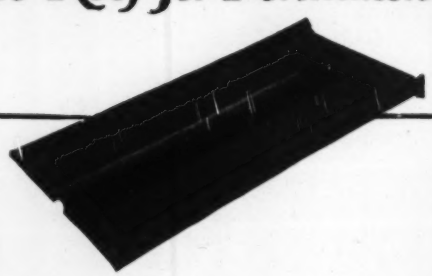

A Consolidation of Engineering News and Engineering Record — McGraw-Hill Company, Inc.—JAMES H. McGRAW, *President*

ENGINEERING NEWS-RECORD

DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

E. J. MEHREN, *Editor*
FRANK C. WIGHT, *Managing Editor*

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Leviathan—Queen of the Seas

TO TAKE a ship, the largest in the world in tonnage, which had lain at anchor for over three years, and which never in her nine years had made a normal voyage, and so to re-equip her and re-design her that she becomes the fastest liner afloat is a feat worthy of notice. That is what American naval engineers have done to the "Leviathan." When the old "Vaterland" made last week the 25-hr. run of 687 nautical miles—an average of 27.48 knots—she broke the record held by the "Mauretania" by 11 miles and 0.44 knots. The world's largest ship is also the fastest and she becomes so by the work of the American engineers who entirely changed the driving power with which the Germans were never able to approach the speed just made. The "Leviathan" is not the entire American merchant marine but she is the queen ship of the fleet. It behooves Americans, especially those who bewail our lost prestige on the seas, to patronize her and her sister ships.

More Bridge Floor Fires

NEW evidence of the reality and seriousness of the fire hazard in wooden bridge floors continues to accumulate. Three destructive bridge fires have just been added to the record, as reported in the current week's news. The loss in any such fire is large enough to warrant careful attention to the fire hazard at the time of construction. Development of adequate fire-protective construction will doubtless require time. A useful beginning, however, was made a year ago through the work of a special co-operative committee which reported on the subject after detailed study. The report, published in *Engineering News-Record* of Nov. 9, 1922, lays particular emphasis on the value of firestops, a device that has hitherto found only occasional use. That it is a worth-while protection may be judged from the account of the recent Stevens Point fire, which repeats the story of many former fires in the matter of rapid longitudinal spread of the flames along the bottom of the floor, under the stimulus of an evident longitudinal chimney effect. In the absence of access openings through the floor such a fire, once started, is virtually beyond control. The simple and cheap expedients of firestops and access openings are capable of saving most of the loss caused by bridge floor fires.

Fundamentally Wrong

EVERY aspect of the conflict between the Pennsylvania R.R. and the Railroad Labor Board, which came to a climax in the formal rebuke of the railroad company last week, is unfortunate. Primarily it is unfortunate that the labor board is not provided with power to enforce its decisions even though as in this case the wisdom of its finding is to be questioned. Without such power it will soon become useless. In fact it may already be useless for now there is no reason why the labor organizations should not follow the example of the Pennsylvania. In the second place it is unfortunate that the labor board let the case come to this climax knowing, as it must have, that it lacked the power of enforcement. The question at issue was a debatable one; the law does not specifically state what form the employee representation shall take, and consequently need not have been made an issue as long as the actual dispute between the Pennsylvania and its employees was on a fair way to settlement. And finally it is unfortunate that the railroad company defied the labor board even though it considered the findings fundamentally wrong. If they were wrong the case could have been reopened and the Pennsylvania could have gone into the court with clean hands, and could, moreover, have looked to its employees to abide by the board's findings in some future time when the situation might be reversed. Now it can do neither. We believe that the principle for which the Pennsylvania was fighting is right, but that its method of conducting the fight is wrong. If the great corporations openly defy this administrative tribunal how can they or the country expect individuals or minor organizations to respect it.

Connecticut Still Vacillates

THE vacillation and delay in the adoption of a policy and method for water pollution control in Connecticut, noted in these columns in 1921, has been continued by the action of the 1923 legislature. The result is postponement of action for two more years and an apparent further befogging of the main points at issue. The governor acted wisely in vetoing the emasculated bill outlined in our news section, since it virtually let go scot free industrial plants located in cities and might have handicapped if not ruined the so-called "country" mills and factories, as well as any others discharging their wastes directly into streams instead of into public sewers. Too much stress seems to be laid by the governor upon the public health aspects of the bill in view of the fact that, as he states, public water supplies are protected by existing laws.

Highway Department Turnover

IN an average session of three months the legislatures of our states have more or less completely overturned fourteen highway departments. This is about 30 per cent turnover—a figure fairly comparable in size with those which are turning gray the hair of contractors and other employers of labor. Of course such a turnover in highway administration is not recorded every year. Last winter was open season for highway departments and the political pot-hunters were active. It is not however the percentage of turnover that is significant, but the fact that state governors and legislators and even the voters who pay the bills regard with entire complaisance the disrupting of a business organization of the magnitude of a state department of highways.

The 14 states which have changed partly or wholly their highway executives and managers are each doing an annual business of between $5,000,000 and $10,000,000 in road construction and maintenance. If a similar turnover should occur in private businesses of corresponding magnitude bankers and business associations would take a high hand in correcting a situation regarded as dangerous to industrial and commercial existence. There is evidently a vast need that the public should be made to realize that their highway departments are immense business organizations of a highly specialized character doing an annual business which surpasses in money value all but a few nation-wide private enterprises. Changes in personnel, often, and even drastic reorganization, occasionally, are required in highway departments, as in other business organizations, but neither popular impulse nor political expediency should be the inspiration for such action. Both were large influences in this year's changes.

Human Nature and Tunnel Driving

DRIVING tunnels isn't all machine work; a knowledge of human nature helps. Out on the Pacific Coast recently in one of the latest power tunnels a new drill better fitted than the old ones to drill the 20-ft. and deeper holes demanded by the new large rock sections was set up alongside the standard drills. Despite the fact that the drill had been tested out in this particular heading by the foreman and shown to work well, the crews did not get good results with it. It was too heavy, they said, and there was no denying the fact that it was often out of order. Too often, in fact, for such a substantially built device. Strangely enough, too, foreign material, such as pieces of file, was generally found in the mechanism when it was turned in as "out of order." The superintendent did not quit, however. He merely withdrew the drill from this particular heading, waited until the incident was no longer in the limelight and then "stored" the drill in the tool house at a heading where the lightest drills on the job were in use. Gossip about such matters gets around a camp quickly and soon after the drill arrived a driller on his way in to his work stopped at this tool house and asked to see "that —— —— drill those fellers at adit 3 couldn't make work." He looked it over carefully and then called to his helper, "Come on, we take this one in." With the larger and more effective tool the two men completed their drilling thirty five minutes ahead of the others and then walked out of the tunnel *taking the drill with them.* After this, prejudice against the new type of drill was no longer a menace; instead a demand for it sprung up and within six months it was used exclusively throughout the entire project and was giving entire satisfaction with a more rapid rate of progress than was possible before.

Municipal Construction and Money-Costs

THE rise in construction costs and in the interest or yield rate for bonds is a double handicap on municipal improvements. The construction-cost index for June is 220.7 against 166.62 for June, 1922, and 273.8 for the peak of June, 1920, or it is 32 per cent higher than a year ago, 121 per cent above the 1913 level and only 19 per cent under the peak. The cities have, therefore, to pay more for the work they require. At the same time the interest or yield rate on municipal and state bonds has been going up in the last few months. For the week ending June 15 the yield rate on bonds offered by 16 states and municipalities was 4¼ or higher for seven issues, while in only one instance was the yield rate as low as 4 (Troy, N. Y. 1 to 20-year 4¼'s selling at 4). The actual interest rates were 5 per cent or more for 8 of the 16 offerings and below 4¼ for only 1 of the 16 lots. Earlier this year interest rates of under 4½ and yield rates of about or under 4 were frequent. Were it not for the fact that many of these bond issues are offered to finance improvements to which there have been commitments not readily put aside, the unfavorable market for materials, labor and money would cause a sharper and more immediate decline in the volume of construction work than has yet been the case. If present construction- and money-costs keep on the up grade the need for municipal improvements and consequently the lag is bound to increase. Eventually much of it will be met although some projects are bound to die. Under such conditions there is more need than ever for wise discrimination between the work that should be undertaken, regardless of unfavorable conditions, and that which without undue sacrifice may be postponed to a more auspicious time.

A Disheartening Dismissal

NO MOVE ever made has been more destructive of the morale of the engineer in the federal service than the peremptory ousting of Arthur P. Davis as director of the United States Reclamation Service. For forty years Mr. Davis has faithfully served the government and through regular and deserved promotion had risen to become the executive head of a bureau of more distinctly engineering character than any other of similar size under civilian control, a bureau, moreover, which engineers have successfully administered since its initiation. And yet he is removed without explanation and with no opportunity for defense, to meet the needs of what must be regarded as purely partisan politics. The administration cannot well escape the charge of debauching the government service in the interests of self perpetuation.

The incident has two sides, that of Mr. Davis himself, with its implication as to all other engineers in the government, and the larger one of the administration of government engineering bureaus, with its implications regarding a department of public works. As for Mr. Davis he will be able now to enter a consulting practice which has long awaited him at a compensation much greater than he has heretofore enjoyed, taking with him the respect of his professional associates to compensate him somewhat for his reflections on the ungratefulness of republics. His fellow engineers in the government know, however, that one of the compensations they have felt they enjoyed in public employ, the security which is supposed to make up for the numerous superior attractions of private employ, is at the mercy of any political superior who chooses to override the civil service laws by the simple subterfuge of abolishing the office. This knowledge cannot help but increase the already great difficulty of providing competent engineers for the work the government has to do.

What is in the mind of the Secretary of the Interior in this dismissal it is not permitted us to know. He takes refuge in the sole statement that he prefers to have reclamation work in charge of a business man rather than an engineer, but in order to avoid the necessity of showing wherein the engineering control has been unsatisfactory he abolishes the office of director

and substitutes a new one of commissioner, thus depriving the automatically removed director of a hearing on his dismissal. And to succeed this engineer who has grown up in the service, one of the most competent men in both the science and business of reclamation in the world, the secretary—a doctor of medicine whose life work has been the conduct of an asylum for the mentally deficient—appoints a not too successful country banker who has been a governor of Idaho. Is there any reason why the charge should not lie that the administration politicians want to have the leverage of the Reclamation Fund to use where it will do the most good? If Mr. Davis was incompetent he is entitled to know in what particulars; if the engineering control of an engineering activity has been a failure the engineers of this country are entitled to know wherein that failure lay and how a so-called business administration made up of doctors and politicians is to be superior.

The engineers who have been favoring a federal department of public works must be profoundly depressed by this incident. It has been their contention—and it has been the contention of this journal—that the engineering operations of the government must be administered by engineers who could be remote from political interference and thus free to devote to the government the full measure of their professional service. Dr. Work has shown how difficult it will be to keep the politicians out of government engineering. He has made some who are opposed to the military system of public works feel that the stability of that system is a virtue as well as a defect. It may be deadening to initiative and inducive of arbitrary class distinction but it does prevent political control.

Training for Leadership

LAST week at Ithaca the Society for the Promotion of Engineering Education carried as a slogan at the masthead of the program the brave words—"Training for Leadership." Around that slogan the program was built, starting with an address by the dean of the college where the meeting was held and ending later in the week with an after dinner speech by the president of the society. In between, the rôle of the engineer as a leader in industry, business, transportation and public service were discussed by specialists in those lines of endeavor. It is no secret that these addresses, all well prepared, some eloquent and all thoughtful, left the hearers cold—not to the desirability, or even inevitability, of the engineer assuming a leader's part in the world's affairs, but to the possibility of so training him in his undergraduate days as to insure for him such a part.

There is an old story of a little boy who when asked what he was going to do when he grew up answered, "I'm going into the millionaire business." So too the advertising pages of certain magazines are filled with instructions how to earn fabulous weekly incomes or to dominate one's fellows merely by following some prescribed system available at so much per course or per week. To set out avowedly to train engineering students so that they become leaders of men savors too much of a little boy's vague ambition or of a charlatan's easy road to success. The engineering teachers realized this and they emphasized it.

This does not mean that the engineering teachers, any more than the bulk of the profession, question for a minute the world's need for the leadership that the engineering type of mind can give. As Dean Kimball so well pointed out the military leader, who ruled by force, has passed away; the legal leader, who rules by precedent must similarly succumb to the revolutionary developments and discoveries that render precedent useless as a rule for future guidance not only in the material but even more in the social and spiritual; there remains the scientific leader, who is guided by fact and fact alone but who possesses that one essential of the imaginative spirit, the willingness, nay more, the anxiety to believe that anything is possible. The engineer, who gives the skeleton of science a corporeal existence and breathes into it life, must step forward out of the crowd into the forefront of the world.

How then can the embryo engineer be trained to take this leading place? By specifically guiding him individually toward leadership; by consciously directing his course of study to that end? Hardly. Leaders are born not made. Few privates carry the marshall's baton in their mental knapsack. To take the mass of the human material presenting itself for an engineering education and to attempt to mold it toward the one end of directing the affairs of this world would be to grievously overestimate the importance of training and, more than that, of the engineer's place in the world. All the educator can do is to formulate as well as he can those qualities of thought and practice which characterize the engineering type of mind and methods, qualities that the changing character of the world make ever more necessary for the conduct of the world, and then endeavor so to instruct the student that he will go forth endowed, within his own limitations, with those qualities. If he knows the laws of nature, can by reasoned processes apply those laws to specific cases and can persuade other men that his application is not only correct but profitable, he will have the essentials of leadership. The remainder of the way lies in himself and the teacher can do little more than point it out.

One paragraph in an address at Ithaca by W. E. Wickenden, of the American Telephone & Telegraph Co., is a clear expression of this thought. "There are some things which colleges can do to a higher degree than any other institution. They can train men to think logically, to study effectively, to investigate with discrimination, to plan intelligently, to work systematically, to express themselves with clarity and vigor, to appreciate and enjoy things of beauty and to pass valid judgments on their own work and that of others. There are some things which colleges can do to a less complete degree, such as training men to know other men's minds, to estimate human relations, to co-operate with their fellows, to strike a just balance between details and general relations and to decide issues on the basis of evidence, even when it is not wholly conclusive. There are other services which they can render in degrees which vary widely with the individual's capacity for response, such as to stimulate the imagination, to clarify the ethical sense, to develop self-confidence and the willingness to assume the consequences of one's own decisions, to recognize ability and to delegate responsibility."

It was with full recognition of these possibilities and limitations that the engineering teachers regarded the slogan at last week's meeting. If they continue to recognize them in their work of teaching, the slogan has its value as a beacon to steer by. It is far from being a complete chart of the voyage.

Ontario Provincial Railway Extending to Hudson Bay

New 190-Mile Line to Encourage Settlement and Develop Mineral and Power Resources—Airplanes Check Surveys—Construction Methods—Electrification

WITH a port on James Bay (Hudson Bay) for its objective, but with the main purpose of opening up new country for settlement and mineral development, the Temiskaming & Northern Ontario Ry. is building a 70-mile extension north from its present terminal at Cochrane, Ont., as the first section of a 190-mile line to Moose Factory at the south end of James Bay. It is expected that contracts for the construction of the remainder of the line will be awarded this summer. Special features noted in this article are the exploration and location survey work, use of airplanes to check ordinary surveys, construction methods and equipment, water power development and the recommended electrification of the present main line. Views of the work and the country are shown in Figs. 1 and 2, and Fig. 3 is a map of the new line.

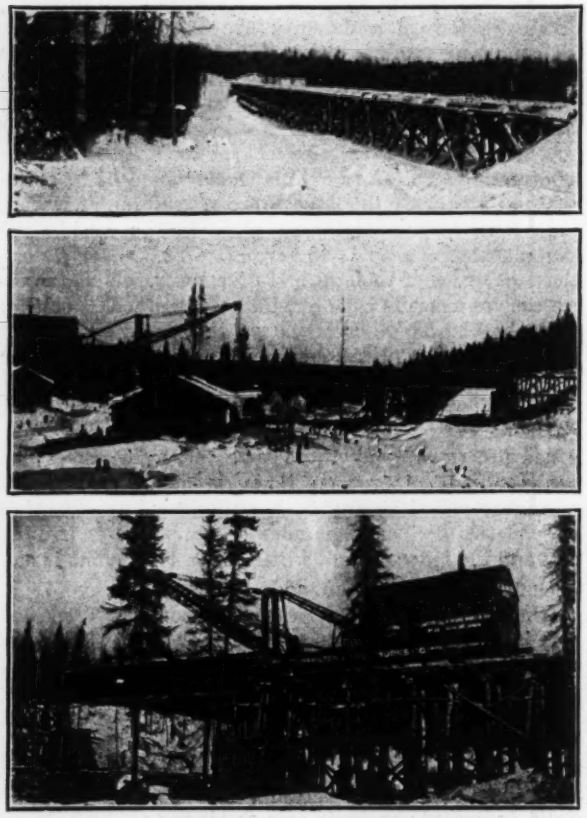


FIG. 1—BRIDGE AT SUCKER CREEK; T. & N. O. RY. Top; temporary structure, with trestle approach to be filled later. Middle and bottom; placing two 85-ft. spans on concrete piers, Mile 20.3.

Government Railway Project—This railway was built by and is both owned and operated by the province of Ontario, under the control of a commission appointed by the Provincial Government. In 1902 the Province commenced the construction of a colonization railway northward from North Bay, on the Canadian Pacific Ry., to New Liskeard at the head of Lake Temiskaming. For about a thousand miles through Ontario the transcontinental line of the Canadian Pacific Ry. crosses the south face of the great "pre-Cambrian shield," which extends from the Great Lakes northward to Arctic waters, and is the largest and most important physiographic feature of Canada. This area had been commonly thought to have no economic resources, other than its rapidly diminishing pine and spruce forests, and it was quite unpopulated, except for sparse settlements along the Canadian Pacific Ry. The provincial railway was primarily projected to open to settlement large areas of fertile clay land that lie between Lake Temiskaming and James Bay, and form what is now known as the northern Ontario clay belt.

About two years later the Dominion Government undertook the construction of the National Transcontinental Ry. between Quebec and Winnipeg. The route of this railway across the Province of Ontario lay entirely in the drainage area of the rivers draining into Hudson Bay, and in a large part through the above clay belt. The Provinical railway was later extended northward to meet the Dominion railway, reaching the connecting point at Cochrane in 1908, thus facilitating the construction of the new Transcontinental line eastward and westward from this point.

At that time it was expected that the Temiskaming & Northern Ontario Ry. would be a connecting link between the Grand Trunk Ry. and the proposed Grand Trunk Pacific Ry., for a route from Toronto to Winnipeg and the Pacific Coast. But owing to war conditions and the Grand Trunk's loss of control of its Pacific extension this plan never became operative. At present the Grand Trunk, the National Transcontinental and the Grand Trunk Pacific are all absorbed in the government system of the Canadian National Railways.

Although the Temiskaming & Northern Ontario Ry. has remained as a local line it has served the development purpose for which it was originally projected. A great area of the clay belt is being cleared and put under cultivation, pulp and paper mills have been established, numerous hydro-electric installations have been made and the construction of the railway has led to the discovery and development of silver and gold mines of international repute. In fact, it is said that with the construction of this railway the frontier of Ontario was moved about 250 miles further north. When the National Transcontinental Ry. was projected, running westward across the northern and practically unknown part of Ontario, it was shown that it would open up a great territory of good but hitherto inaccessible country north of the "height of land." With the new railway now being extended north from this line to James Bay another strip of land will be made accessible and the frontier moved still further northward.

The winters are long and cold, with a minimum temperature of 30 to 35 deg. below zero, and there is snow on the ground for at least five months of the year. The summers are short, usually hot and dry, but the nights are cool. There are only about two months without frost.

Mineral Resources—As to the mineral developments in this region, Dr. C. V. Corless, director and manager

of the Mond Nickel Co., in an address before the Canadian Club of Toronto, stated that probably the greatest advantage of the extension of the Provincial railway will be in rendering the shores of James Bay and Hudson Bay and the tributary rivers accessible to explorers and prospectors for four or five months of the year. The Hudson Bay Ry., in Manitoba, will have a similar effect when completed. He predicted the discovery of great mineral wealth in this newly opened territory. Referring to the five great groups of mines already found on the southern fringe of the pre-Cambrian shield (Lake Superior iron, Michigan copper, Sudbury nickel, Cobalt silver and Porcupine gold) Dr. Corless said: "These five fabulously rich mining areas with numerous other minor discoveries, some of which may develop into very important mines, are all situated in a small part of the pre-Cambrian shield, the part we have very incompletely examined merely because it was accessible. The remainder of this vast shield is similar in glaciation and geological formation. Further, where prospectors have secured a new point of attack, as near The Pas, in Manitoba, made accessible by the Hudson Bay Ry., they have discovered valuable mineral deposits."

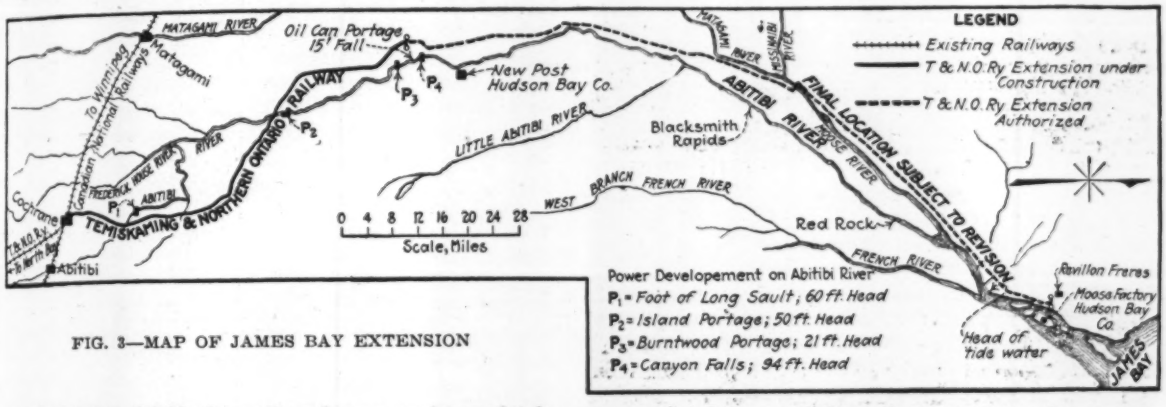


FIG. 3—MAP OF JAMES BAY EXTENSION

Exploratory Work—Exploration surveys north of Cochrane have been carried on intermittently for several years. Little was known of this territory except along the larger rivers, of which traverse surveys had been made. Traveling by canoe routes was relatively easy, but the forests on either side were practically impassable. During these early surveys information was collected respecting the timber, soil, water powers and mineral resources. An examination was also made of all possible harbors on the south side of James Bay.

It was found that there would be no serious construction difficulties to determine the location of the extension. The problem was, therefore, the location of a route that would best serve to develop the intervening territory, and that would reach a terminal on tidewater at which a harbor could be developed to meet the requirements of whatever navigation should offer. The mouth of the Moose River proved to be the most desirable site for a harbor, with the terminal located on the west bank of the river opposite Moose Factory, which is an old Hudson Bay Co. post on an island in an estuary of the river. It is anticipated that the construction of a railway to Moose Factory will create considerable interest in James Bay and Hudson Bay, and that during the navigation season of five months a considerable amount of coastwise shipping will be carried on. From a geological standpoint the prospects of finding valuable minerals along the shores of Hudson Bay are very favorable, but as the bay is practically inaccessible very little prospecting has been done. In selecting the route from Cochrane to Moose Factory the most direct line has not been followed, but it is believed that the route as adopted will open a large area to settlement and will better serve to promote the establishment of pulp and paper mills on the Moose River and its tributaries.

Ordinary and Airplane Surveys—Initial surveys were carried on by methods usually followed in northern Canada, the only means of transportation being canoes in summer, and toboggans and dog teams in winter. Subsequent to the completion of the exploratory surveys and the selection of a route, the Laurentide Air Service, Limited, established an air station near Cochrane, at which a number of modern seaplanes are available for commercial flying, and the railway engineers have made some use of the machines.

These seaplanes were not available when the exploratory and reconnaissance surveys were made, but it is considered that they can be used to advantage in making exploratory surveys in unmapped country. After the completion of the reconnaissance surveys the engineers used the seaplanes to a slight extent to check up results of their previous surveys. It has been the experience on this work, however, that aerial surveys cannot take the place of preliminary instrumental surveys, since the topography of the country is such that the slope of the river valleys, etc., cannot be determined with sufficient accuracy without levels from trial lines. On the other hand, the flights made have served to check the information which was obtained by more laborious methods.

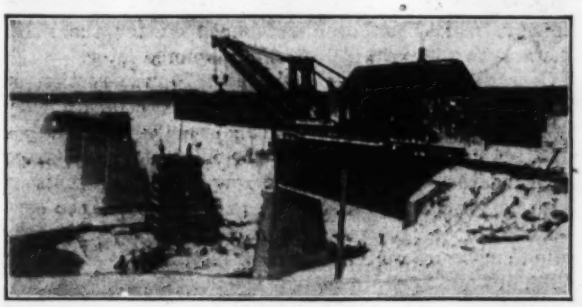


FIG. 2—PLACING 110-FT. SPAN; ABITIBI RIVER BRIDGE
March 20, 1923. Note double-boom erection car. Spans on the far shore were erected before the temporary trestle removed.

Final location surveys are now being completed to Moose Factory by two survey parties. Each party con-

sists of a chief of party, transitman, leveler, topographer, two rodmen, two chainmen, four to six axmen, cook, cookee and two to four packers or canoemen. A transport party is responsible for transportation of supplies to main caches, from which the location parties draw when required. The entire operation is in charge of a chief locating engineer who co-ordinates the work of the various parties.

In connection with the location surveys, topographic surveys have been made of the water-powers on the Abitibi River (see Fig. 3) in order to determine clearances for structures crossing the Abitibi and its tributaries. In all cases these structures are being designed so that they will not restrict the future development of water-power sites (see Fig. 4). Information obtained from the hydrographic surveys was used also in connection with the studies for the electrification of the track. Air-operated dump cars of 16-yd. capacity are used for making fills, the number of cars per train varying from six to twelve. Temporary trestles made from round timber, on piles where necessary, are used in making embankments with these trains. At the end of April, track had been laid to Mile 44.4, where foundations for a large bridge across the Abitibi River were being constructed. The grading between this bridge and the end of the contract at Mile 70, was fairly well covered.

There has been comparatively little trouble from sliding cuts, but the bottoms of a few cuts have been very soft, necessitating cross logging to hold up the track. Nor has there been excessive settlement of fills, except in one cut at Mile 5 where a 14-ft. embankment had to be carried across a marsh. As a rule the embankments are not originally made above grade line to allow for

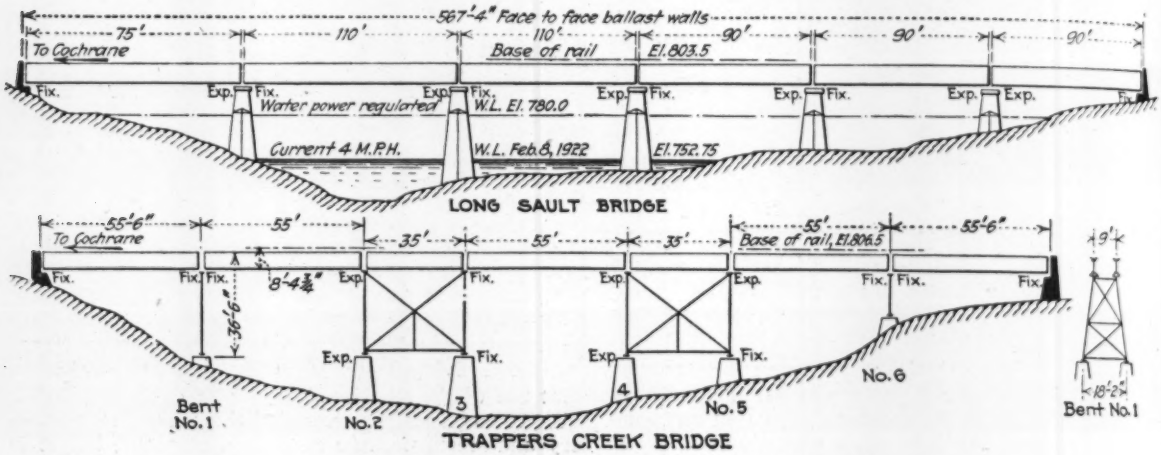


FIG. 4—TYPICAL BRIDGE AND VIADUCT CONSTRUCTION

railway, which has been recommended for the main line and two important branches, as noted later.

Construction Work—On the first 70-mile section of the James Bay extension the work is comparatively light, the grading averaging about 14,000 cu.yd. per mile. About 40 per cent of the fill material is from cuts and the balance from borrow pits. The limit of free haul is 500 ft. Maximum grades are 0.4 per cent southbound and 0.6 per cent northbound, with a maximum curvature of four degrees. Roadbed width is 18 ft. on fills and 24 ft. in cuts. The location profile showed no solid rock, but a small quantity has been encountered in some of the deeper cuts. All clearing has been done on the 99-ft. right-of-way, this work being handled generally by the stationmen preparatory to the work of grading.

Side borrowing is done usually by stationmen, using wheelbarrows for making the fills. In some places where the land is drier than usual, scrapers have been used to make embankments from side ditches. Line cuttings are generally taken out by pick and shovel, the material being removed in narrow-gage dump cars hauled by horses. Two steam shovels are in operation, both with 2½-yd. dippers. One is being used for ballast and the other for filling dump-car trains.

The contractor's equipment is of standard gage, except that small narrow-gage cars are used in taking out line cuts. Owing to the nature of the country it is difficult to move steam shovels ahead of the standard-gage settlement. There is naturally some slight settlement, but this is taken up later by using train hauled material, which is generally sand, providing better drainage than the material usually found in line cuts. It has not been necessary to use cross logging under the embankments on account of swamps.

Structures and Track—All structures are of permanent construction. The smaller culverts are of reinforced-concrete pipe, except in a few cases where corrugated metal pipe is used on account of greater facility of transportation. The larger culverts are of a flat-top type built of reinforced concrete. In the deep clay of glacial origin pile foundations are necessary for most of the structures. Spruce suitable for piling is generally found adjacent to the right-of-way. The larger creeks have deep ravines and these are crossed by steel trestles, the clay banks of the creeks not being sufficiently stable to permit the construction of large culverts or high abutments.

Typical bridge work is shown in Figs. 1, 2, 4 and 5. The largest structure is the crossing of the Abitibi River, Mile 44.4, which has a 220-ft. deck truss center span and plate girder flanking spans on concrete piers, with steel trestle approaches. All structures are designed for Cooper's E-60 loading and in accordance with the Canadian Engineering Standards Specifications. Trouble was experienced in unwatering pier 2 of the Abitibi River bridge at the Long Sault, Mile 11.3, and in order to avoid delay to tracklaying a temporary

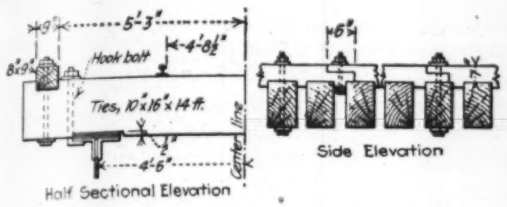


FIG. 5—DETAILS OF BRIDGE DECK

structure was erected between piers 1 and 3. During the winter, when tracklying was suspended, this temporary structure was removed and the two 110-ft. spans were placed, as shown in Fig. 2.

Bridge decks, Fig. 6, have ties spaced about 14 in. c. to c. with 8x9-in. guard timbers boxed or dapped over the ties. To prevent breaking of the ribs between the daps, four 3-in. nails are driven in each rib before the timber is dapped. These timbers are spliced either over or between the ties, as shown, according to the length of the timbers. Since gravel and cement for bridge foundations had to be brought in by rail, temporary trestles were built at several structures in order to avoid delay. The temporary trestle of the Sucker Creek bridge, Fig. 1, will be filled.

Track is being laid with 80-lb. rails of A. S. C. E. section, laid to break joint and spliced with heat-treated angle bars. Fig. 6 shows a Roberts tracklaying machine at work on a muskeg or swamp fill. The ties are of local jack pine, untreated, with 18 ties per 33-ft. rail length. Pit gravel is used for ballast and is 10 in. deep under the ties. Passing sidings 3,000 ft. long are provided at intervals of six miles and the turnouts have No. 11 frogs. The location of stations will depend on settlement. Woven-wire 52-in. fencing for the right-of-way is attached to 8-ft. cedar posts, placed 16½ to 33 ft. apart.

Swastika-Kirkland Branch—In order to assist the development of the Kirkland Lake gold mining area, about five miles east of Swastika (on the existing main line south of Cochrane), a branch line is being built eastward along this mineralized zone. It is intended to build about twenty-five miles this summer, and probably the line will be extended ten miles further to the interprovincial boundary. Preliminary surveys are now being made. This will be built as a comparatively cheap branch line, using 10-degree curves and 2 per cent grades where necessary. By using these maximum

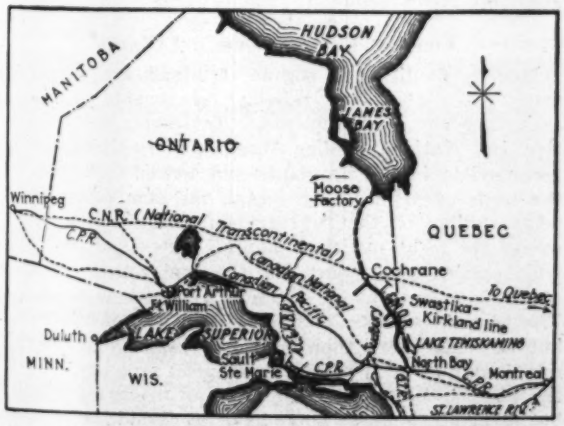


FIG. 7—KEY MAP OF NORTHERN ONTARIO

grades and curves, the grading quantities will be only about 15,000 cu.yd. per mile, about evenly divided between rock and sand. There will be no structures of importance.

Electrification—In connection with this railway it is of particular interest to note that after careful study electric traction was recommended in 1922 as economical for the 250-mile main line from North Bay to Cochrane and for the two branches to Porcupine and Iroquois Falls, 33 and 7 miles respectively. Power could be developed at hydro-electric plants along the line and on the basis of using 3,000-volt direct current it was estimated that the reduction in operating expenses would be materially greater than the interest charge on the investment. Although the amount of traffic is less than is usually considered necessary for economical operation by electricity, this condition is said to be more than counterbalanced by the power cost. Thus, coal for the locomotives averaged $9.50 per ton in 1921, while it is estimated that current can be generated and delivered to the trolley wire for not more than ¾c. per kw.-hr. The total cost of equipment, exclusive of generating plants, is estimated at $11,215,000.

Immediate electrification was not recommended, it being considered that further investigation should be made, especially as to hydro-electric installations, and that complete plans and specifications should be prepared first so that definite bids for the work can be invited.

FIG. 6—TRACKLAYING MACHINE ON MUSKEG FILL

Engineers and Contractors—For the 70-mile section now under construction the general contractors are Grant, Smith & Co. & McDonnell, Vancouver, B. C., who have sublet the clearing and grading to Noehren & Mannix, of Calgary, Alberta, and the concrete masonry to C. D. French & Co., of Montreal, Que. Steel bridge work, including erection, has been let to the Hamilton Bridge Works Co., Hamilton, Ont. It is expected to have this section completed in October, 1923, at an approximate cost of $3,500,000. Final location surveys are being made for the remainder of the extension to Moose Factory, and the contract for this construction will probably be let about August, 1923.

The Temiskaming & Northern Ontario Ry. is under the jurisdiction of a commission appointed by the Provincial Government, with Geo. W. Lee as chairman. The engineering staff consists of S. B. Clement, chief engineer; W. R. Maher, chief locating engineer; A. L. McDougall, division engineer in charge of construction, and A. A. McRoberts, assistant engineer in charge of design of structures. The investigation and report on electrification was made by Mr. Clement in conjunction with J. G. Kerry, Toronto, consulting engineer for the Commission.

Further Tests on Concrete-Encased Steel Floor Joists

STRENGTH TESTS of concrete-encased steel beams reported in *Engineering News-Record* of May 3, p. 800, were extended in subsequent tests to higher loads and to vibratory loads, and the observed stresses were compared with calculated stresses on the basis of reinforced-concrete action of the composite structure. The results, recently reported by Profs. H. M. Mackay, Peter Gillespie, and C. Leluau to the steel fabricators' section of the Canadian Manufacturers' Association, are held to indicate that in such encased-beam construction the concrete and steel act together to form a composite beam, which may be designed by the usual reinforced-concrete T-beam theory; that this action may be utilized to effect a considerable economy in floor design; and that the limits of bond stress between concrete and steel which should be observed in such design require further tests to determine them. The experimenters also report that it is advantageous to provide for continuity at the ends of the beams by reinforcement passing through the top of the slab, that the shear reinforcement provided by the webs of the beams will tend to eliminate failure from diagonal tension, and that these encased beams are in a more favorable position than reinforced-concrete beams because of the fact that the concrete carries no stress from dead-load.

Previous Tests—As reported the live-load was carried up to 220 lb. per square foot which was double the design live-load for a stress of 16,000 lb. per square inch in the beams; the panels were 15 x 16 ft. in size, of which a slab area 10 ft. wide and 16 ft. long carried by two 10-in. 22.4-lb. I-beams spanning .16 ft. and spaced 5 ft. apart was subjected to load. In the further tests the live-load was carried up to 365 lb. per square foot, or 3½ times the design live-load or more than twice the design total load. This increased the live-load flange stress in the steel from 7,600 lb. per square inch to 14,750 lb. per square inch, and made the total flange stress (dead plus live) 21,500 lb. per square inch. Slight haircracking in the lower portions of the beam encasement, one or two cracks extending to near the bottom of the slab, appeared during the higher stages of loading. The test was discontinued because it proved impracticable to place more load on the panel. Comparison of the measured steel stresses with those computed by calculation of the structure as a reinforced-concrete assemblage showed the observed results to lie between those calculated for the case of full tension in the concrete and the case of no tension in the concrete; in the latter case a part of the slab was counted as acting with the beam encasement to give T-beam action, this slab width extending four times the slab thickness to either side of the beam encasement. In the lower stages of loading the results agreed closely with those for the case of tension in the concrete, while in the upper stages of loading the results diverged more and more toward the other basis of calculation.

Before carrying out the tests under increased load, the panels were loaded with a concrete mixer of gross weight 10,400 lb., and this mixer, containing a 500-lb. charge of stone and operated by compressed air, was run "at a good speed" for two days. Its weight produced bending moments corresponding to those of a uniform live-load of 115 lb. per square foot. Strain-gage and deflection readings taken before and after the running of the mixer checked the weight of the mixer but indicated no vibration effect, and some slight haircracks that had been noticed in the previous tests showed no further extension, "although the amount of vibration produced would have been quite excessive in a building."

Truck Load Limits Reduced by New California Law

THE MAXIMUM load that may be carried by motor vehicles operating on improved state or county roads in California was reduced by the recent legislature in that state. Heretofore the limit for vehicle and load has been 30,000 lb.; this is reduced to 22,000 lb., effective Aug. 31, 1923, but vehicles weighing 10,000 lb. or more which are registered prior to Aug. 31, 1923, may operate with 24,000 lb. gross until Dec. 31, 1926.

Cities and counties may by ordinance increase the permissible weights but may not reduce except on unimproved roads, on bridges or for emergency. The maximum permissible weight per inch width of tire channel base is fixed at 700 lb. and the total gross weight for 6- or 8-wheel vehicles is set at 34,000 lb. Only one trailer may be used, whether laden or unladen. Body widths are limited to 96 in. over all, but cities or counties may increase this. The limiting speeds are established as follows:

Gross Weight	Maximum Speed
9,000 lb. but less than 12,000	25 miles per hour
13,000 lb. but less than 22,000	15 miles per hour
Over 22,000 lb.	10 miles per hour

Trucks or trailers constructed to carry 4 tons of load are limited to 15 miles per hour, laden or unladen.

Taxes and fees will be as follows: For each motor vehicle, trailer or semi-trailer, registration fee, $3; for the first set of license plates $5, each additional set $3.

Motor vehicles, trailers and semi-trailers equipped with solid tires will pay a weight tax on the following basis:

Unladen Weights	Tax
Under 3,000 lb.	$10.00
3,000 and under 6,000 lb.	20.00
6,000 and under 10,000 lb.	30.00
10,000 lb. or more	40.00

Pneumatic-tire vehicles pay one-half the foregoing weight tax and vehicles weighing less than 3,000 lb. and with cushion tires are considered as equipped with pneumatic tires. A gasoline tax of 2 cents per gallon goes into effect Sept. 30, 1923.

Leasing Engine Terminal Plants

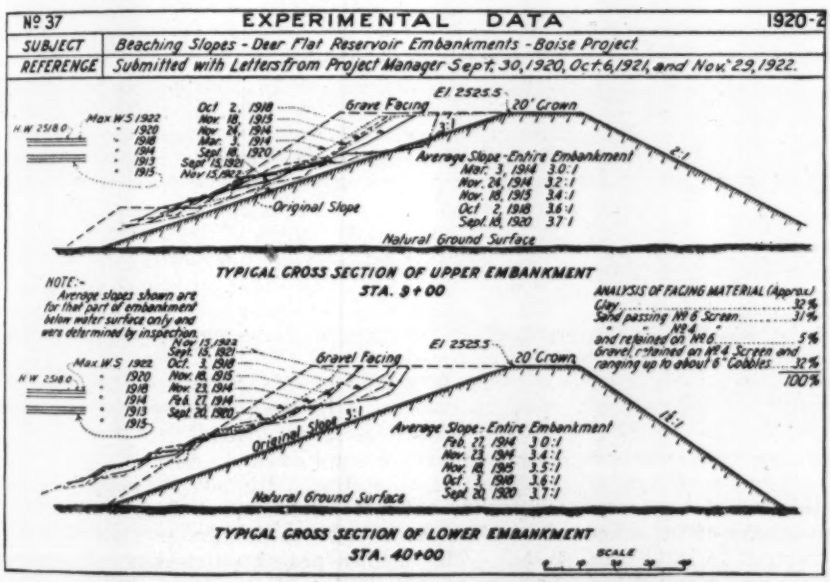
Modern facilities at engine terminals are needed in many cases where the railways are unable to finance such needed improvements. To meet this condition the National Boiler Washing Co., Chicago, has arranged to install its plants and special apparatus on the basis of payment by rental, the plan being somewhat similar to that of car equipment trusts. Payments are to be made on monthly notes and the plant will remain the property of the contracting company until the railway makes the final payment on the lease. The plan is similar to that of car equipment trusts, but the cars carry their own mortgage while the terminal equipment is put on mortgaged property. While the plant is being paid for it is an operating charge, but after all the lease notes have been paid the railroad can take title to the property and put it into capital account at its depreciated value.

Observations on Beaching Slopes on Reservoir Embankment

Abstract of Paper by C. A. Bissell, Engineer, U. S. Reclamation Service, in March "Reclamation Record"

FOR eight years cross-sections have been taken of the Deer Flat reservoir embankment of the Boise Project of the U. S. Reclamation Service to determine beaching slopes. Originally, the finished slopes were purposely much in excess of the present ones, but profiles for the last two years indicate they are now practically stable.

The reservoir is formed by taking advantage of a natural depression in the hills and closing the gaps by earthfill dams. The length of the upper dam is 4,000 ft. and of the lower one 7,200 ft. The former has a maximum height of 70 ft. and the latter 40 ft. The area of the reservoir is 9,800 acres and its greatest length, almost squarely facing the lower embankment, is nine miles. At the time of construction the extensive area and exposed position of the lake indicated that at times the wave action would be strong and that protection was accordingly important. No rock was to be found in the vicinity of either embankment and the distance from railroad connections made the importation of rock from a distance very expensive. The same conditions made the cost of concrete high and pavement with this material would also have been expensive. The importance of the question was emphasized by the great extent of the water slope in each embankment and it was finally concluded to try the experiment of protecting these slopes by an excess quantity of coarse gravel.


No 37
EXPERIMENTAL DATA
1920-2
SUBJECT
Beaching Slopes - Deer Flat Reservoir Embankments - Boise Project
REFERENCE
Submitted with Letters from Project Manager Sept. 30, 1920, Oct. 6, 1921, and Nov. 29, 1922.
El 2525.5
20' Crown
Gravel Facing
Average Slope - Entire Embankment
Original Slope
Natural Ground Surface
TYPICAL CROSS SECTION OF UPPER EMBANKMENT
STA. 9+00
NOTE:-
ANALYSIS OF FACING MATERIAL (Approx.)
Clay 32%
Sand passing No 8 Screen 31%
" " No 4 " and retained on No 8 ..... 5%
Gravel retained on No 4 Screen and ranging up to about 6" Cobbles 32%
100%
TYPICAL CROSS SECTION OF LOWER EMBANKMENT
STA. 40+00
SCALE

BLEACHING SLOPES OF UPPER AND LOWER DEER FLAT DAMS
Reproduced from *Reclamation Record*, March, 1923

After finishing the dam to the lines required by the drawings, with 3 to 1 water slope and 20-ft. top width, the equipment on the ground was employed in widening the top by dumping from cars on the water slope the coarsest material available, moving the tracks outward as the top width of the embankment increased. This material was composed of water-worn sand and gravel, varying from cobbles of 50-lb. weight through all the intermediate sizes to very fine sand, the proportion of coarse material varying some but not much. In this way the upper embankment received about 95,000 cu.yd. of extra material, which was deposited on the water slope, taking its natural angle of repose and widening the top of the embankment to a width varying from 51 to 67 ft. A larger quantity was necessary on the lower embankment as this is much longer. It required about 226,000 cu.yd. of material.

Cross-sections have been taken periodically, beginning in 1914, to determine the slopes to which this gravel had washed down. A recent letter from J. B. Bond, project manager, states that cross-sections taken last fall show no material changes over 1921 conditions, the difference being so slight that they would not show up on cross-sections of the scale of the drawing.

In 1922 Deer Flat Reservoir was filled to its maximum designed capacity on April 20 and was held at that stage until May 5, after which date it was gradually drawn down.

At the time of construction it was estimated that it would be possible to repeat the process of gravel reinforcement at least twice before reaching the cost of paving the entire water slope. It seems certain that this never will be required. At the lower embankment the advent of the railway since the embankment was constructed opens the possibility of employing either rock or concrete at some future date should further operations appear to be required. The present indications are that considerable economy is likely to be accomplished over the cost of paving the embankment slopes by the usual methods at time of construction.

Sixty Long Timber Columns Tested

RESULTS of tests of 60 columns of Southern yellow pine and coast type Douglas fir, 12x12 in. x 24 ft. long, have just been reported by the Forest Products Laboratory, Madison, Wis. These tests are part of a much longer test series, intend to extend over a four-year period, covering both green and air-dried material, summer-cut and winter-cut, of various grades from clear and dense to defective and light-weight. The columns so far tested include 40 of Southern yellow pine, most of them true long-leaf pine, and 20 of Douglas fir. The length was chosen to give a true long column, that is, one which would fail by buckling without exceeding the elastic limit of the material; shorter columns cut from the larger ones are to be tested later. In all three groups composing the set of 60 columns, the average of the ultimate (maximum) load of the several columns was 95 to 96 per cent of the Euler load computed from the constants of the column and its modulus of elasticity, the latter having been obtained in a preliminary bending test. The columns were tested "under what may be considered pin-end conditions." In the three series the lowest and highest failure loads were 201,500 and 432,600 lb.; 187,900 and 418,400 lb.; and 182,000 and 406,300 lb. The last figure is based on 19 columns, the twentieth having been found to have a defect that required its exclusion from the series. The tests have been interpreted as indicating "that there is little, if any, difference in the long-column strength of the two species," namely, Southern yellow pine and Douglas fir.

Results of 2x2-in. columns cut from the large timbers showed failure loads proportional to their stiffness moduli, indicating "that knots in themselves do not greatly affect the column strength."

Earth Dam Built by Flooding Dry Fill

Depth of Dry Fill Successfully Compacted by Flooding Was Remarkable Feature of Diversion Dam for Water Supply and Irrigation at Wichita Falls, Texas

By Albert S. Fry
Morgan Engineering Co., Memphis, Tenn.

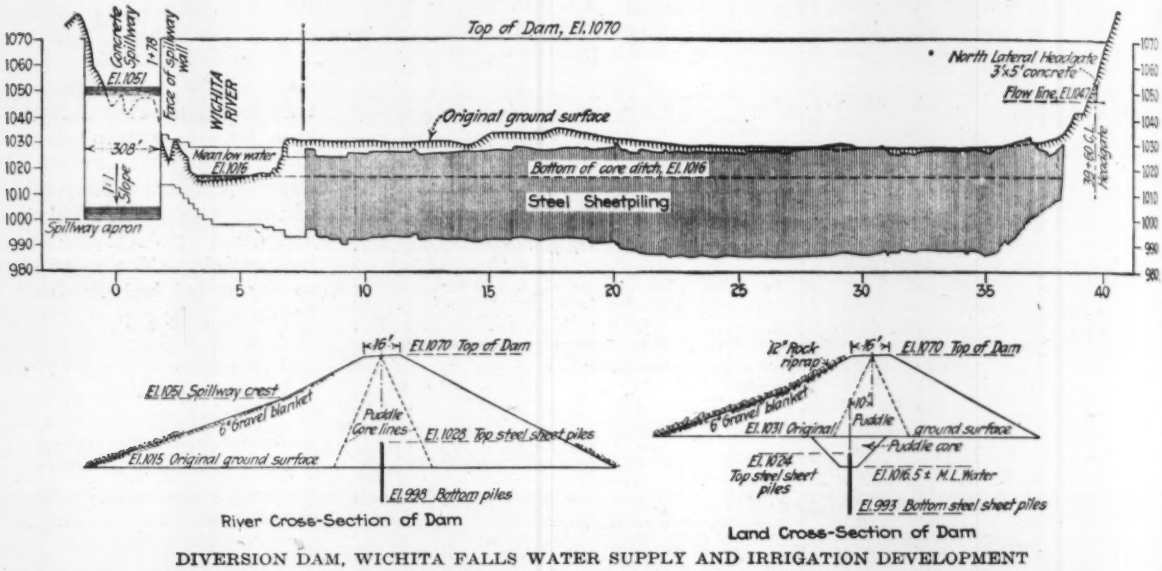
A POROUS earth, easily soaked, made the flooding method particularly advantageous for constructing the smaller of the two earth dams for the irrigation and water supply development near Wichita Falls, Texas (*Engineering News-Record*, June 21, p. 1080). It is thought that in building this dam greater depths of fill were consolidated by flooding than in any previous operation. Fills 3 ft. deep were successfully consolidated and dried out ready for the succeeding lift of embankment in from seven to twelve days.

As described in the preceding article the main storage dam of the development works is supplemented by a smaller diversion dam. While this will be a costly structure when completed, the topography of the country is such that it was more economical to build both a storage dam and a diversion dam than it was either to build a storage dam at the site of the present diversion dam or to construct an irrigation canal extending 15 miles from the storage dam to the site of the diversion dam. Under the plan which was adopted, the diversion dam will raise the level of the water about 20 ft. above the valley floor to the elevation of the intake into the main irrigation canal which carries the water to the agricultural lands and to Wichita Falls.

Construction—Construction of the diversion dam began in January, 1922. The cutoff trench was excavated 10 ft. upstream from the center line of the dam by a walking dragline machine. Material from the trench was deposited in both toes of the dam. The excavation extended an average depth of 15 ft. to low water level in the river, which was nearly the same elevation as the river bed. In the bottom of the trench, a row of steel sheet piling, weighing 35 lb. per square foot, was driven to refusal into the underlying shale. The top of the piling extended a minimum distance of 8 ft. above the bottom of the trench. The longest piling driven was 43 ft.

Before backfilling the trench with clay puddle, it was pumped full of water from the river. Material from a borrowpit on the downstream side of the dam was loaded into dump wagons by a tractor and elevating grader. Two dump wagons were connected together and were drawn by tractors. The first method used was to dump the wagons at the edge of the cutoff trench but this method was abandoned because of the difficulty in getting the material into the trench. By the second method the material was dumped at the downstream toe of the dam and moved by a dragline excavator into the trench. This method proved satisfactory. The earth from the trench which had been put into the toes of the dam was leveled down to a height of about 4 ft. and the dragline moved along on this material in refilling the cutoff trench. In depositing the material, the bucket was dumped near the edge of the trench so that the tendency would be for the heavier particles to deposit along the side of the trench and the very fine material to deposit in the center and along each side of the piling, thus taking as much advantage as possible of the hydraulic grading of the material.

For a distance of about 700 ft. at the beginning of the work, after the material from the cutoff trench had been leveled down to a height of about 4 ft. above the general surface, the puddle core was extended up to this level in the same manner as that used in refilling the trench. However, on account of the cost of puddling, this method was discontinued for the remainder of the dam and the puddle was carried up only to the original ground surface and the fill up to the 4-ft. level



DIVERSION DAM, WICHITA FALLS WATER SUPPLY AND IRRIGATION DEVELOPMENT

FLOODING THE EMBANKMENT IN SECTIONS 300 FT. LONG
Settling 3-ft. fills under water pumped in after deposition by teams and wagons. Material has 45 per cent voids and dries quickly.

was made in the same manner as the fill for the remainder of the dam.

Originally it was intended to roll and sprinkle the earth embankment but it was found that the material was adaptable to the use of settling under water and this method has been used. Material for the embankment is being taken from borrow pits both up and downstream from the dam, hauled on to the dam and placed in lifts about 3 ft. deep. After about 100,000 cu.yd. of material had been placed by the dragline machine rehandling the material into the embankment, after it had been dumped at the toes from wagons, the method was discontinued and the remainder of the dam is being built by teams and dump wagons.

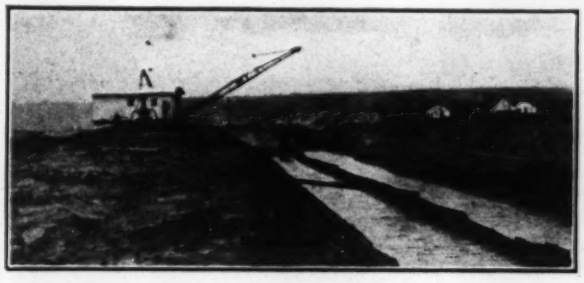
In each lift the embankment is separated into sections about 300 ft. long by small levees along the sides and across the embankment. These sections are flooded with sufficient water pumped from the river to cover the fills with a pool 1 ft. deep. This amount of water is ordinarily sufficient to saturate the material thoroughly, but in case it is not more water is pumped on later. The time for the entire lift to become saturated varies according to conditions. Where the material was placed in the embankment by the dragline excavator, the earth where the dragline traveled was packed so hard that it required from 4 to 8 days for complete saturation. Where the fill is made by teams or tractors and wagons, the time of saturation is reduced to 3 or 4 days. When tests show that saturation is complete, the pool is drained, and the material dries out in from 3 to 8 days, depending largely on the temperature, so that the next lift can be placed.

It is planned to top out the dam with teams just as the present valley section is being built, except that the flooding method will probably be discontinued above the elevation of the spillway and the material which is too dry to compact suitably by team travel will be sprinkled.

The material available for this dam is very favorable to the flooding method of construction, as it contains about 45 per cent of voids, therefore saturates readily and dries out in a short enough time so that the work is not delayed waiting for the fill to become firm enough to work upon. The economy of this method of construction depends on the character of the soil as to whether or not it will become saturated easily. Heavy soils which do not saturate readily require the fill to be placed in thin layers. In other places where the Morgan Engineering Co. has used this method of construction, material has been placed in layers of only 12 or 18 in. Where such low lifts are necessary, the unit cost of the embankment is increased and other methods of construction may be more economical. On the diversion dam, however, the soil was adaptable to lifts of as much as 3 ft. and accordingly the flooding method offered an economical way to construct the embankment.

The rock riprap has not yet been placed on the diversion dam, but particular care will be taken in laying the stones and all of the openings between the stones will be hammered and rammed full of spalls with a sledge down to the gravel blanket. It is believed that by taking these extra precautions in placing the riprap, the comparatively thin layer (6 in.) of riprap adopted will be more satisfactory than a thicker layer with the rocks merely dumped on to the face of the dam. The riprap constructed in this manner will be so nearly solid that very little if any material will be sucked out by wave action through the interstices between the stones.

Spillway—The concrete spillway section of the diversion dam is located in the side of the hill at the south end of the dam. It was necessary to set this section over into the hill in order to secure a good foundation at a reasonable depth for the heavy concrete overflow section. The headgates and intake to the main irrigation canal are located just above the south end of the spillway and the intake structure will be joined to the spillway. An approach channel to the spillway through the side of the hill and a channel below the spillway to lead the water from the stilling pool back into the river channel are being excavated.



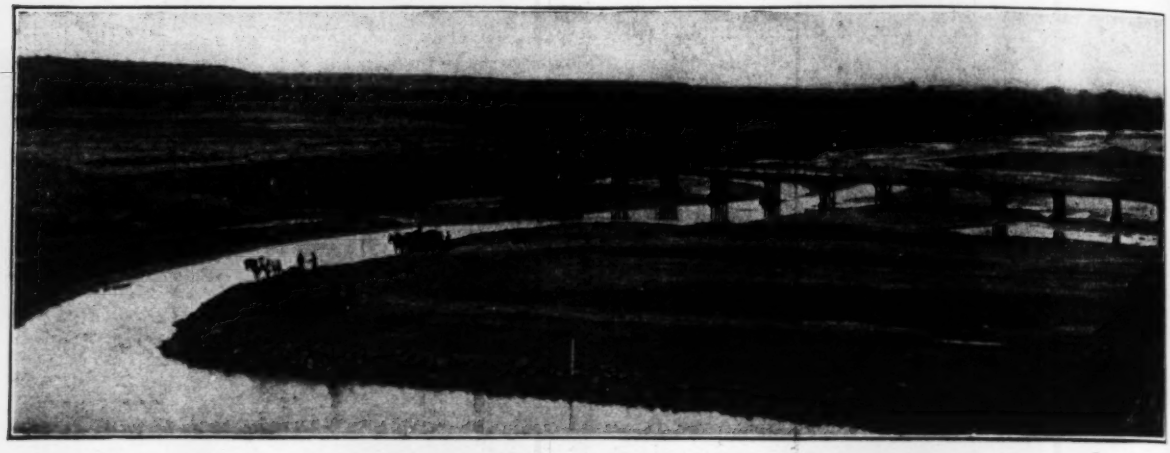
BACKFILLING CUTOFF TRENCH WITH DRAGLINE
After the trench was dug piling was driven down the center extending 8 ft. above the bottom of the trench and water was pumped in. The backfill was placed in water.

Excavated material is being placed in the river channel beginning at the south bank and crowding out to the north, leaving a part of the old channel at the north side of the present channel about 75 ft. wide to carry the flow of the river. The material across the channel is being placed in the toes of the dam, leaving a trench in between the toes which finally will be filled with puddle. Steel sheet piling will then be driven through the puddle across the channel. There will be some surplus material from the excavation for the spillway and the intake works in addition to that required in the embankment across the river. This surplus will be hauled across the river channel on a pile trestle and placed in the earth section of the embankment just north of the river channel.

Clay Blanket—In order to protect the restricted section of river channel from washing excessively during such floods as may occur, a 3-ft. blanket of clay has been placed on the sandy bottom of the river bed. On the downstream toe of this clay blanket, riprap 15 or 20 ft. wide has been placed extending along the bed

of the river. A timber flume 60 ft. wide and 50 ft. long with suitable cutoff and wing-walls at the entrance will afford additional protection to the river channel gap. At the downstream end of the flume, a plank mattress securely wired to the lower end of the flume with the downstream edge free to move up and down as the sand is scoured out will prevent destructive action at the outlet. This mattress is in sections 10 ft. wide and 15 ft. long, wired securely together. The flume will have a depth of 5 or 6 ft.

The construction of the storage dam was sufficiently advanced by March 1, 1923, so that ordinary floods could be controlled by allowing the water to store above the constructed portion of the dam and thereby prevent damage to the diversion dam from such floods. The temporary flume constructed across the restricted section of the river channel will carry the water which comes in from the drainage area between the two dams without danger to the works. Should an unusually large flood occur which would require the opening of the conduits in the storage dam to the point where they would pass a large volume of water, the temporary flume would not be sufficient and there world be risk of losing part of the embankment at the diversion dam. Under the contract this risk is assumed by the contractor.



FILLING IN RIVER CHANNEL AT DIVERSION DAM

To prevent scouring of the narrowed channel during floods the sand and gravel in the river bottom were blanketed with clay.

Berlin Sewage Farms in Use Fifty Years

Sewage farming is still used in Berlin, according to a letter from Dr. Ruths of the city administration. The only change since the irrigation fields were put in use in 1873 has been the enlargement of the settling tanks so that nearly all the suspended matter in the sewage is removed before the sewage is applied to the land. This makes possible a higher rate of sewage application than before as well as the continuous use of the fields. The effluent from the irrigated areas, says Dr. Ruths, is perfectly clear and increases the fish population of the river into which it is discharged. Distribution is by open ditches. Sandy soil, once sparsely covered with grasses or trees, now produces fruit, vegetables or, if in grass, five or six crops of hay annually. The volume of sewage pumped to the sewage farms is about 500,000 cu.m. daily (132 m.g.d.). The area irrigated is some 11,000 hectares (27,000 acres).

Elastic Modulus of Sand Foundation Measured in Holland

TESTS of the elastic modulus of the foundation material were necessary for the safe and economical design of a very large tide lock about to be built at Ymuiden, where the Amsterdam Canal enters the North Sea. The results were recently reported by M. Wolterbeek, of the public-works department of Holland; an abstract is given by A. Bijls in *Le Génie Civil* of May 26. Proper calculation of the bending moment in the floor of the lock requires a knowledge of the elastic reaction of the sub-soil. This reaction was taken as proportional to the vertical deformation, but for the numerical calculations it was necessary to determine the modulus of the soil, or the load per square inch per inch of depression. This quantity was determined by measurement on the bottom of a shallow pit exposing undisturbed, saturated sand (below groundwater level). A square bearing block was placed on the floor of this pit, carrying a loading platform confined by post guides on either side. Bearing blocks of various sizes were used in different tests, the length of side ranging from 4 in. to 28 in. (areas 100, 500, 1,000, 2,500, and 5,000 square centimeters). A marked lag in the deformation was observed, both in loading and in unloading. It was assumed, however, that any depression remaining 24 hours after unloading was permanent, and by this criterion the total depression in each instance was divided into elastic and permanent. For a load of 5½ lb. per square inch or 800 lb. per square foot, the permanent deformation was less for the large than for the small bearing blocks, while the elastic compression increased quite decidedly with the size of bearing block, amounting to 0.08 mm., 0.20, 0.29, 0.58 and 1.34 mm., respectively, for the five sizes of block. The modulus of elasticity correspondingly decreased from 1,730 lb. per square inch per inch for the small block to 102 lb. for the largest block.

Panama Canal Transits

The rapid increase in the United States intercoastal trade is shown by a comparison of the record of Panama Canal transits for the month of April for the past four years: 1920, 7 vessels; 1921, 19; 1922, 24; and 1923, 95 vessels.

Road Surfaces and Motor Transport

International Congress at Seville, Spain, Considers Six Questions Equally Divided Between Surfacing Methods and Highway Transport Practice

(Special Correspondence)

PRIMARILY the discussions of the International Road Congress which was held May 6 to 13 at Seville, Spain, were concerned with the needed changes in road construction to meet the increasing burden of automobile traffic. There were six questions submitted to reporters, as follows:

1. Surfacing of roads with concrete.
2. Use of bitumen and asphalt for surfacing.
3. Laying of tramway-rails on the various kinds of road surface.
4. The development of motor transport.
5. General traffic regulations.
6. The problem of traffic on congested roads and streets of towns.

Preprints were furnished to the delegates, containing reports from 13 countries and from 149 persons of whom 81 were residents of the United States. The method of operation of these congresses is: A number of individual reports from competent reporters are received from the various countries. These are then referred to a general reporter, who, through custom, is a native of the country in which the congress is held. The general reporter then summarizes the individual reports and draws conclusions in so far as these seem to be justified. These conclusions are then put before the congress for discussion and action.

The conclusions are taken up in caucus by delegates from the nations. In this case the French delegation had prepared conclusions which in many cases were entirely rewritten from the conclusions of the Spanish reporters. The French conclusions formed the basis of discussion by the English caucus, and finally the conclusions as modified were presented to the final meeting of the congress and adopted. The delegates from the United States had no official standing, and were invited to share in the English caucus.

With respect to the conclusions, the following is noticed: First, in drawing up conclusions which will apply to the colonial possessions of France in Morocco, to Paris, London, and the United States, the form must be very general, and would appear to be mainly a citation of the obvious. In the second place, delegations from the Latin countries appear to regard these conclusions as very important, since they could be taken to be directive of action by those who had power to regulate the construction and use of roads in their respective countries.

Again, the Latin nations concluded that subsidies should be granted to automobile transport, which is entirely opposed to the views of the United States. In fact, in Italy, where the railroads are under governmental ownership and regulation, subsidies are granted to motor transport lines which of course are only established to fill the needs of passenger transport for isolated districts which do not enjoy modern transportation or are not served by the railroad. The government grants a concession for the operation of such lines by private persons, and meets the deficit in the operation. Similarly, the Italian government has granted a concession for the construction and operation by private persons of a road exclusively for automobiles from Milan to the Italian Lakes. The French railroads operate passenger bus service over the highways. In fact, the acute controversies arising in the United States between the leaders of thought in the railway and highway fields do not seem to have arisen on the continent. Indeed, it may be remarked that the recent measurements of highway traffic in New England show that only a small portion of traffic is really competitive, and instances again the necessity of informing oneself before feeling.

A traveler, desiring to appraise highway development in Europe, or to reach conclusions from the experiences of these countries in highway transport, must make up his mind to devote considerable time to examination, and to learn the reasons for the conflicting reports, as, for instance, the relative economy of the tramway and motor bus operation in the cities of England. The economic conditions and the habits of the people are so different from those of the United States that care must be exercised in transferring principles and practices in either direction. The United States has been forced to build new roads to carry the remarkable burden of automobile traffic, and has the wealth to finance these constructions. The continental nations have roads well located, well drained and with solid road-beds, but not the economic conditions with which to face a widespread extension of motor transport. However, in some places, the increase of motor vehicle movement corresponds with that in the United States. The problem in the continent is distinctly one of surfacing existing roads.

While the conclusions of the congress are very general, yet the engineers of these countries will find in the reports a body of useful information.

Deliberations of the Congress—The congress was held in two sections, the first dealing with resurfacing of roads was attended by approximately 200 persons; the second dealing with more general phases of highway transport, was attended by approximately 50 persons. Approximately 600 persons in all were in attendance. The usual difficulties of international congresses were experienced in the time lost in translating remarks into two other languages than that of the speaker; and at this particular congress there was considerable lack of formality of debate. As in many other meetings of associations, considerable energy appears to be misused in the formulation of the obvious. There is also a common tendency to frame ideas into conclusions without respect to the data of experience and experiments. The vast body of experimental data available to the road engineers of the United States does not seem to have been known by the European engineers.

Entertainment—The very hospitable local committee had provided for the delegates an interesting program of entertainments characteristic of Andalusia. The

organ recital in that most glorious of all cathdrals, the Seville Cathedral, will linger long in the memory of the delegates. After the congress an excursion was provided to Granada and Cordova.

Question 1. Surfacing of Roads with Concrete—In the continent the desire to obtain a cheap construction that will be more resistant to heavy modern traffic has led to various forms of construction in which stone blocks or broken stone are bound together with lean or rich mixtures. For instance, the Cornet system in Belgium uses a binder of ten parts of slag, two parts of slaked lime and one of cement. The road is constructed of two layers of broken stone between which a layer of mortar is interposed. The first layer of stone is leveled and rolled, and a bed of mortar, approximately 1½ in. thick, is laid. Then a second layer of stone is spread and also rolled. The operation is expected to fill the voids in the stone road with mortar.

Recourse is also had in France and Italy to special patented products such as "Rhoubenite" and "Soliditit." Rhoubenite is an invention of a Belgian engineer, R. Houben, who endeavored to obtain an impermeable concrete by incorporating saw-dust impregnated with a special mixture of tar and bitumen, thus producing a powder which is mixed in a proportion of about 60 liters to 400 kilos of cement. The powder is added to the concrete mixer. After a few turns of the mixer, the concrete is carried in trucks to the site of the work. This Rhoubenite was used first in 1912 on the road from Brussels to Namur.

In all, some 72 installations of various forms of roads bound together with cement are reported from Belgium from 1910 to 1920, and 18 of these are of so-called Rhoubenite.

In Italy two trials of Portland cement concrete for roads were made in 1911. During 1914, 1915 and 1916, some ten concrete road constructions were reported in Italy. The esplanade in front of the central station in Milan is reported as in excellent condition after eight years' wear under rubber-tired wheels. Other roads in Milan, supporting traffic of an industrial type, are rapidly deteriorating, but are reported to have been executed in a very imperfect manner. Italians have made use of the system called "Soliditit," first in 1913 in a tunnel under the Quirinal, but without success.

Two concrete facings were made in 1920 and 1921 on a highway supporting a traffic of more than 3,000 vehicles per day. One of these roads which was flat and very damp, contains many cracks and deep ruts. The surface of the other, a 45 per cent grade, remains in good condition. At the Octroi gate on this last road, where the wheels must follow two narrow tracks, a wear of 2 cm. has been measured.

The Italian engineers stress the importance of a solid foundation under concrete slabs, so there may be continuous support; and also advise against the construction of two-course concrete roads.

In Holland, 1920, authorization was given to construct concrete facings for a length of 150 m., divided into three sections of 50 m. each: first, a section of 1:2:4 gravel concrete; second a two-course construction with a lean base; third, reinforced-concrete pavement of a mix of 1:1½:3. The work was installed in the spring of 1921. On the national highway between Amsterdam and Amersfoort the construction seems to have been conducted under careful management, and was opened to traffic after a period of one month. The first section, after 10 months' use, had to be reconstructed with asphalt blocks, and the second section showed enough wear to inconvenience the traffic; the third, reinforced section, has shown no signs of disaggregation. No difference is noticed in the amount of cracking between the reinforced and non-reinforced part of the roadway.

The reports from nine English engineers were incorporated in a report by Alfred Dryland of Middlesex County, England, summarizing their experience with concrete pavements during the last four or five years. A number of experimental installations of concrete roads have also been made in Spanish countries.

The congress concluded that cement concrete for carriage ways formed of materials of good quality and suitably proportioned, built on sound and well-drained foundations, are capable, if the work is carefully executed, of withstanding considerable traffic of heavy vehicles fitted with rubber tires, but that further investigations are required as to the effect of traffic consisting of a large portion of steel-tired vehicles. A mix of 1:2:3½ was recommended. One of the American delegates expressed his opinion that concrete pavements might be constructed of much leaner concrete, possibly 1:3:6. The congress mentioned the use of special cements as justifying the adoption of different proportions. It did not appear advisable to express an opinion as to whether reinforced concrete should be employed in preference to mass concrete, and thorough studies were recommended. The question of providing expansion joints against the effect of various temperatures and humidity was also to be studied. Interesting results have already been obtained following the adoption of a resurfacing method whereby a matrix of sand and lime is added to the macadam during or subsequent to the laying.

Question 2. Surfacing Roads with Bitumen and Asphalt—There has been a much more extended experience in the use of asphalt than in the use of concrete. There are approximately 105 miles of highways faced with bituminous materials in France. Experience with bituminous surfaces on national roads in France extends from 1912 to 1922. Those previous to 1918 were largely experimental, although certain roads constructed in 1913 have withstood a heavy burden of traffic in good shape. An experiment by Michelin is quoted as showing 25 per cent decrease in cost of rolling traction on bituminous roads from those of macadam roads. The French reporter says that the life of the heavily traveled macadam roads in the Seine-et-Oise Department is about one year, and that the cost of the bituminous surface is recovered within three years.

A French reporter lays the cause of the waves in bituminous surfaces to the action of the roller, and suggests a ramming machine as a substitute for the roller.

The English reporters refer to many miles of main roads on which two-coat asphalt surfacing has been laid directly on the existing macadam roadbed. Rock asphalt is found in many places throughout the continent, principally in Switzerland, France, Germany and Sicily. After being reduced to a powder it is spread on the road surfaces and compressed. The percentage of bitumen varies from 6 per cent to 16 per cent. The desirable proportion for working in Great Britain is found to be about 10 and 11 per cent. The

rock is mined and shipped in lumps by steamers. When it arrives at the works it is broken into medium-sized fragments and subsequently ground in pulverizing mills. After being heated it is transported, at a temperature of 340 deg. F., to the road, where it is raked and rammed to the necessary thickness of approximately 2 in., then laid on a cement concrete base. In Great Britain the use of rock asphalt is limited mainly to city streets. Italy has used rock asphalt extensively, the production being 106,000 tons in 1920. In 1849 a road in Switzerland was surfaced with this powdered asphalt rock. In 1860 this material was used for the first time in Zurich where now two-thirds of the total area of the streets is of compressed asphalt surfacing. It is reported that this material is too slippery for roads with steep grades. The limit of grade is 2½ per cent, whereas rolled asphalt can be used up to 4 per cent, according to the Swiss report.

The conclusions of the congress with respect to bituminous and asphalt surfacing were very general. It was recommended that research work should proceed, to determine the cause of corrugations and the means by which they could be avoided.

Question 3. Laying Tramway-Rails on Road Surfaces—The subject of laying tramway-rails on various kinds of road surfaces engaged the serious attention of the congress. It seemed odd to Americans to learn that rails may be laid directly on natural soil of gravel or sand, but a conclusion of this kind is no doubt written to cover conditions in the colonial territory such as Morocco. An interesting construction used by Mr. Brodie at Liverpool is to interpose a bed of pitch between the rail and the concrete foundation as the only fastening. The rail is raised clear of the surface, when practically set, and supported on hard wooden pieces of the same length as the width of the base of the rail, so that the rail is set in position true to line and level. These wooden pieces do not exceed ¾ in. in thickness. Temporary lines of sand or chippings are then laid just clear of the edges of the base of the rail, and a tempered mixture of pitch and oil, to which an equal bulk of hot sand has been added and thoroughly mixed in, both being at a temperature of about 300 deg. F., is then poured into the space between the upper side of the concrete and the under side of the rail until it comes up slightly over the upper side of the base, and completely surrounds and fixes in position the wooden packing pieces. When the mixture cools, the temporary lines of sand or chippings, which acted as small dams to retain the liquid pitch mixture, are removed. The mixture when cool sets to a semi-plastic consistency, and takes a firm grip both of the rail and the concrete, and forms an excellent bond, keeping the rail in exact position, so that no movement of the rail is permitted, and shutting out absolutely the possibility of water finding its way down between the rail and the concrete.

The method when carried out thoroughly, has done away with the trouble from rising sets or displaced paving alongside the rail in tramway streets.

The hold which a satisfactory mixture has on the concrete and the rail is well seen when moving the rail for reconstruction purposes. In such cases it becomes necessary to use heavy levers and bars to bring the rail off its bed, and when the joint is broken it will be found that in some portion of the length of the rail the pitch mixture parts from the rail surface while in others the mixture parts from the concrete and often brings away with it any weak portion of the concrete.

The reports upon this question are of exceptional interest and value. The live discussion of the problems of tramway rails on roads will recall the conference on paving held at the Engineers' Club in Philadelphia some few months ago.

A number of reports were received on the topic "Progress Made in Modern Mechanical Appliances Used in the Construction of Roads." Ten reports were received from the United States, one from France and one from Great Britain.

Question 4. The Development of Motor Transport—The fourth question was the development of motor transport, upon which reports were received from Spain, United States, France, Great Britain, Italy, Netherlands, Switzerland and Czechoslovakia.

In France the number of automobiles in 1920 was 231,074, as follows:

Passenger vehicles	public	20,812	
	private	132,759	
	Total		153,571
Lorries	public	6,364	
	private	71,139	
	Total		77,503
	Grand total		231,074

There were five times as many motor buses in 1920 as in 1913. In 1921 the number of motor vehicles which paid taxes, outside of the three departments, was 287,182, of which 92,730 were heavy vehicles. France has one motor vehicle for each 160 inhabitants; Switzerland one for every 151 inhabitants; and Great Britain one for each 110 inhabitants. France subsidizes motor transport lines capable of transporting at least 20 passengers each way per day, 500 kilos of luggage and 2,000 kilos of goods.

It is considered in France, as in Italy, that the economic conditions will prevent the creation of new railway lines, and that automobile transport, which can be rapidly installed and at a still approachable outlay, must supply the needs for increased transport. There were 164 subsidized motor transport lines in 1921. Many lines have been abandoned by the first contractors, concerning which the French reporters remark that:

> The cause lies more often in that, tempted by the bait of promised subventions, and knowing little about the limitations, maintenance and renewing expenses required for a well established automobile business, having underestimated, if not completely omitted these items, amortization charges on the capital, contractors badly advised undertake engagements which are too onerous and which they very soon find themselves unable to keep. May we express the wish that the Public Authorities warn them against their own impulse and only grant subventions to these contractors or companies having sufficient technical and financial capacities to carry out satisfactorily the services they offer to ensure.

The French reporter gives relative costs of motor transport in 1910 and 1922, and remarks that the whole business of the motor transport situation is dominated by the question of fuel. He discusses the use of the mixed carburant, a mixture of equal parts of alcohol and benzol.

The English reporter speaks of the decay of road transportation after 1850, consequent upon the building of railroads. By 1906 the traffic of the country had

commenced to flow once more over the roads. In 1914 the advance of motor transport was steady until the war, when road transport increased rapidly because of the limitation of the capacity of the railroads. The freeing of motor vehicles from war service attracted a number of drivers to this work, who, being untrained in careful business methods, undertook rates which, while meeting the actual cost incurred and providing a living wage, were insufficient to assure the upkeep of the vehicle and equipment over a long series of years. Meanwhile the railways had been allowed to fall into poor condition. According to the English reporter, the deficiency of the railway rather than the merit of motor transport was the cause of the rapid growth of road traffic, and not until there is free play allowed to economic operating conditions will the question of the advantage or disadvantage of the two forms of conveyance for the two classes of traffic be determined.

A number of instances are quoted of the experience of merchants in hauling various commodities to London by motor trucks, to an economic advantage. The reporter remarks that there are always reasons for the use of the roads other than that of comparative costs. The average haul on the railroads in Great Britain was 50 miles against 186 miles in the United States, in the year 1920.

As in certain portions of the United States, unrestricted competition between motor bus lines has led to unfortunate results, recognized by the motor truck operators themselves who are now desirous of control by public service corporations. The English reporter speaks of the influence of roads in changing the location of cities and the drifting of factories to the surrounding rural areas, which brings forward problems in country planning.

In Italy there is a scarcity of railroads, and automobiles have become a necessary auxiliary of service, with fixed rates and time-tables, in bringing movement and life to the most distant and inaccessible inhabited places, delivering entire regions from their isolation. Motor bus lines are subsidized by the government. In 1905 there was a single subsidized automobile line; in 1921, 631 lines, with a total length of 23,910 kilometers. A number of lines covering 25,000 kilometers are not subsidized, but are under the control of the state, which settles questions of competition and regulates their operation relative to the subsidized lines. Lines destined exclusively for the transportation of goods are run without financial assistance from the state. The reporter concludes that rules serving as a basis of subsidized passenger service could not be applied to goods service, since motor vehicles should never travel empty, which would be the case if fixed time-tables and hours were imposed upon these freight carriers. It is hoped in Italy that better co-ordination between these goods carriers and railway services may be established, so that there will be a single movement from distant points to house-door in an interior town. In 1901 the state imposed heavy burdens on such motor transport companies. In 1904 the principle of subsidizing such roads was established. The motor service suffered so heavily during the war that special efforts were made by the state to encourage the resumption of the highway motor bus traffic by increased subsidies, increased payment for postal service, and in supplying petrol at a special price.

Up to 1914 very few attempts were made to use the motor truck for the transportation of goods, but after the war and the freeing of the immense stock of motor trucks, the road transport of goods increased. The number of motor vehicles in Italy in 1921 was estimated as 100,000, one for every 350 inhabitants. Costs of motor car service are extensively quoted in the report.

The Italian government grants a reduction in traffic tax for automobiles furnished with pneumatic tires. A test is reported at Milan of a good tarred road showing a unit consumption of petrol to be 26.7 grams per ton-kilometer total weight, and 42 grams per ton-kilometer of useful capacity. On an ordinary macadam road in moderately good condition, the consumption was 76.5 grams per ton-kilometer total weight, and 146 grams per ton-kilometer of useful capacity, about three times excess.

It is to be noted that the Italian government has granted a concession for the construction of a highway exclusively for automobiles, from Milan to the Italian Lakes. Tolls are to be charged, based on weight and power of the vehicle.

In Switzerland there is an extensive use of motor buses. The passenger cars increased 560 per cent from 1910 to 1922, and the trucks 1676 per cent. Since the last year of the war, 1918, passenger cars have increased 1.3 times and trucks 2.5 times. In 1904 the postal administration added the first motor truck to its service, and a passenger bus line was installed the preceding year. In 1921 there were 51 licensed automobile services. The principle of subsidy obtains in Switzerland where 20 concerns receive assistance from the states or from municipalities. The private concerns carry passengers in large, open touring cars, running from the larger towns. They are considered to be competitors of the railroads. The reporter from Switzerland gives valuable data on the cost of passenger car and motor truck service.

One conclusion of the Congress with respect to the development of motor transport stated that, where railways and tramways cannot penetrate, traffic should proceed by the highways and be encouraged by the governments, if necessary, by granting subsidies sufficient to insure their existence and in proportion to the service they are called upon to render. Research was recommended into the economical sources of energy. The motor vehicles must be adapted to the roads, so as to diminish the effect of rapid running or heavy traffic; as for instance, including tires, method of suspension and braking.

Question 5. General Traffic Regulations—General traffic regulations have received considerable attention in Europe, and formed the subject of an International Congress in Paris in October, 1921. Exceptions were made for farm vehicles traveling for short distances on the road. The continental regulations are based on the principle that the heavier the car the less the speed. No limits of speed are fixed for cars of a weight less than 3,000 kg. The width of tires was fixed by the specifications that the weight shall not exceed 150 kg. per centimeter of width. Automatic speed regulating devices are recommended for freight vehicles in excess of 3,000 kg. Provision was recommended for an international certificate for drivers and for cars.

The French recognize a distinction between vehicles with solid and with pneumatic rubber tires, and M. Chaix quotes an experiment on a newly built macadam

road, on one side of which trucks weighing 6,500 kg. loaded ran at 22 km. per hour for 2,000 passages. Under pneumatic tires the surfaces were slightly cut up; the wear of material was 0.33 cubic meters. Under solid tires the surface was destroyed; the wear was 5.3 cubic meters. On a tar-macadam surface, the solid tires removed only one-quarter as much material as on the macadam surface.

M. Chaix recommends control of the speed on roads of different classes. Concerning the load per width of tire, he remarks that if the loads are unduly limited, then the number of vehicles must be increased to the detriment of road surfaces. He mentions the placing of brakes on all four wheels as is found on some cars in Europe at the present time. He remarks on the difficulty of applying the force equally to all four wheels and also leaving freedom to the guide wheels. For heavy freight trucks the continental countries provide an apparatus independent of brakes and motor, to prevent the vehicle from running back down the hill when starting.

In England and the continent, steel tires are still found on motor vehicles, especially those propelled by steam. The speed of these is especially limited. In France the law provides that within a term of six years all motor vehicles must be supplied with rubber tires.

Czechoslovakia reports the formation of road regulations as based on the French code of May, 1921.

A table of suggested weights and maximum speeds was introduced in the conclusions, against the protest of some of the delegates who considered that the information justifying such a table was not yet available.

Question 6. Traffic on Congested Streets—Probably the reports on this section will be of most value to readers in the United States, as an exposition of the elements entering into this problem, and the new ideas. The reports on this question by the French and English reporters are of especial excellence. The English are introducing safety first competitions among the school children similar to those conducted by the Highway Education Board in the United States. An observer of continental traffic, especially in Italy, is somewhat surprised to notice that the automobile dominates the situation and that the foot passenger is apologetic.

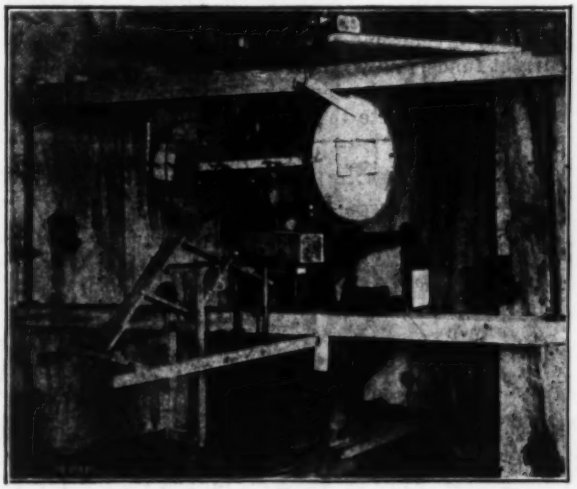
Congressional Committee on Reforestation

Before closing its season's work the U. S. Senate Select Committee on Reforestation made a trip to the Great Lake states to hold public hearings at various cities in those states and to see some of the work now going on. They found that Michigan plans to segregate all lands that are to be used for reforestation and to reduce the taxes on such land to the rate of five cents an acre for a period of twenty-five years. After that time the owners will pay back to the state twenty-five per cent of the value of all products taken. John W. Blodgett, President of the National Lumber Manufacturers Association, recommended that the federal government issue bonds for the purchase and reforestation of at least 3,000,000 acres of land in Michigan, Wisconsin and Minnesota. Filbert Roth, Dean of the Forestry School of the University of Michigan, stated that in his opinion at least 10,000,000 acres should be reforested in Michigan.

Torsion Test Rig for Testing Machine

IN ORDER to secure information for use in the design of rudder posts, elevator spars and aileron beams for aircraft, torsion tests of such members are necessary. No torsion testing machine readily adaptable to large specimens in a variety of shapes being available, engineers at the Forest Products Laboratory, Madison, Wis., built the apparatus which is here shown.

A specimen for test is secured in the two large disks which hold its ends, the motor is started and the motion of the descending crosshead of the machine is transmitted to the disks by the straps attached to the short



TORSION TEST IN UNIVERSAL TESTING MACHINE

beam (shown end foremost) bolted to this head. As this movement is received by the disks it is resolved into a rotation (counter-clockwise for the nearer disk and clockwise for the farther one) and a downward motion of both disks with the specimen. This downward motion, measured at the center of the specimen, proceeds at half the speed of the crosshead of the machine. By means of the supporting framework, the pull on the disks is communicated to the weighing platform on which the lower horizontal beam rests and is registered on the weighing dial of the machine.

The amount of distortion in the specimen, caused by the opposite turning of the disks, is measured by the relative rotation of the arcs fastened to it. As the specimen twists, the light cord on the farther arc is slowly wound onto it while the cord on the nearer arc unwinds. The lower ends of these cords are fastened to a lever system which transmits the average rotation of the arcs to a fine wire passing around a small shaft carrying the pointer of the graduated dial seen in the left foreground. The distortion thus registered in inches may be converted to degrees of arc by the use of a suitable factor. The downward motion of the specimen is eliminated from the dial readings by causing the dial-and-lever system to move downward at the same rate. This correction is effected by supporting the dial on a pantograph arrangement fastened to the crosshead and adjusted to halve the crosshead motion.

The large weights on each side serve merely to counterbalance the weight of the disks on the sides not pendant from the frame. Coil springs inserted in the light chains just above these weights relieve the jar of sudden failure and protect the chains from breakage.

St. Louis Plans Wider Streets To Relieve Traffic Congestion

Major Street Plan Provides Continuous and Wider Traffic Routes to Business District From All Sections of the City

A PROGRESSIVE and well considered plan for the relief of traffic congestion in St. Louis is embodied in the Major Street Plan, funds for which were provided in the bond issue of $67,000,000 voted last fall. An item of $8,650,000 was included in this bond issue for "establishing, opening, and widening streets." With the widening of Washington Ave., and the opening of South 12th St., already undertaken according to the plan from current funds, and with the benefit assessments on property provided by charter, this bond money, as the city's share, will complete the major street plan as now laid down. It is not contemplated that the plan will definitely solve the city's traffic problem. Indeed traffic increases so rapidly that while the proposed street widening and extension will multiply the number of vehicles that can use the streets, it may be that the growth of traffic will surpass the new accommodations and when the plan is completed congestion will still exist. Then, or before then, other means of relief will be required. Estimated at its least, however, the present undertaking is a long step toward improved traffic conditions.

Major Street Plan—Developing westward from the old settlement on the river front, St. Louis grew large without much thought given to planning streets with an outlook beyond the exigencies of the immediate requirements. In general the checkerboard arrangement adopted for the old town was continued. Radial streets as a planned means of direct access to the business center were not considered. The streets shown on the map, Fig. 1, as having a somewhat radial location—Broadway nearest the river and the route made up of Gravois and Florissant Aves. linked in the business section by 12th, High and 15th Sts.—were so located to conform to the curve of the river and not as planned radial arteries for traffic. Moreover, the link through the business section formed by S. 12th, High and 15th Sts. was broken at *A* and at *B*. All these streets, like most of the rectangular streets in the business section, were narrow.

With the street situation as briefly outlined and as indicated by Fig. 1, the City Plan Commission, Harland Bartholomew, engineer, after a careful study, reported a Major Street Plan to meet the arising traffic conditions. The nature of this improvement is indicated by the map. It is chiefly a task of street widening and in a few cases of opening new link streets. Incidentally on these streets new paving is called for and it will be designed for heavy traffic. The traffic situation that the plan is designed to improve has grown almost beyond control.

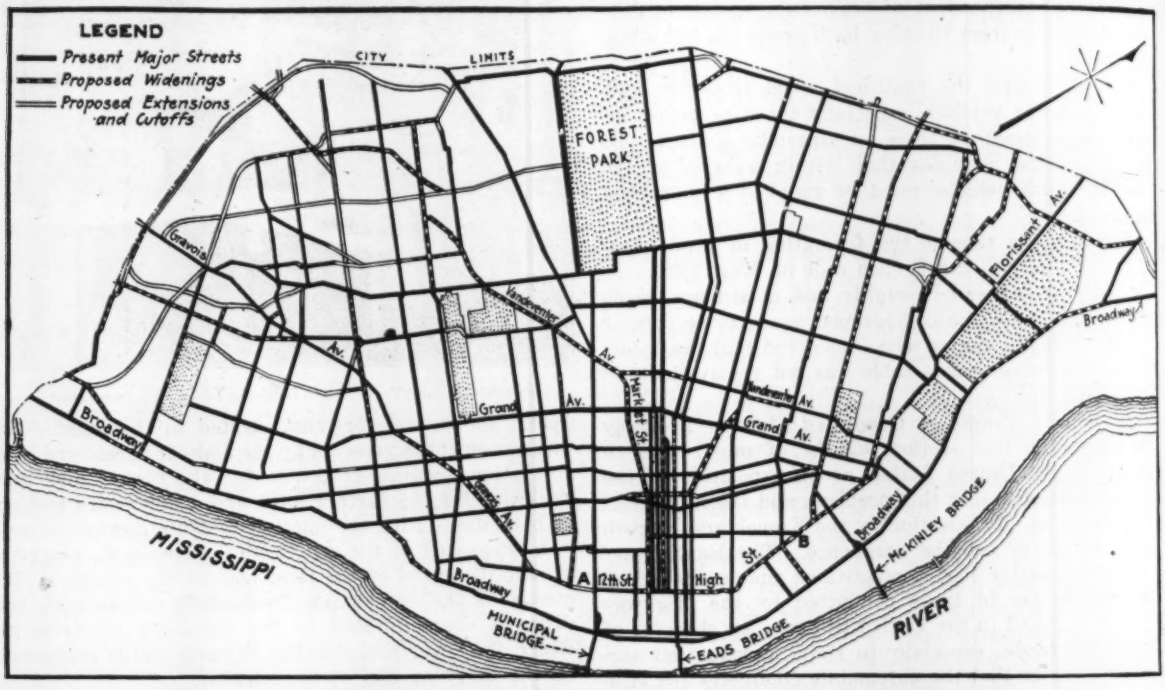


FIG. 1—MAJOR STREET PLAN TO RELIEVE TRAFFIC CONGESTION IN ST. LOUIS, MO.

Traffic Development—In 1914 in St. Louis there were 9869 licensed motor vehicles; in 1921 there were 60,473. It is predicted that in 1926 there will be 200,000 licensed vehicles. This is not considered an illogical assumption. Los Angeles, Calif., for example now has over 200,000 motor vehicles and it is a smaller city than St. Louis. With the completion of the vast improved road programs of Illinois and of Missouri, a constantly increasing number of outside vehicles will come to the city. A large portion of this traffic comes to the business section of the city, which is approximately the area lying between 12th and 4th Sts. and Washington Ave. and Market St. This traffic at present is compelled to follow a few parallel east and west streets.

Concentration of traffic to and from the business district on a few east and west streets would be presumed from a study of the map, without further evidence.

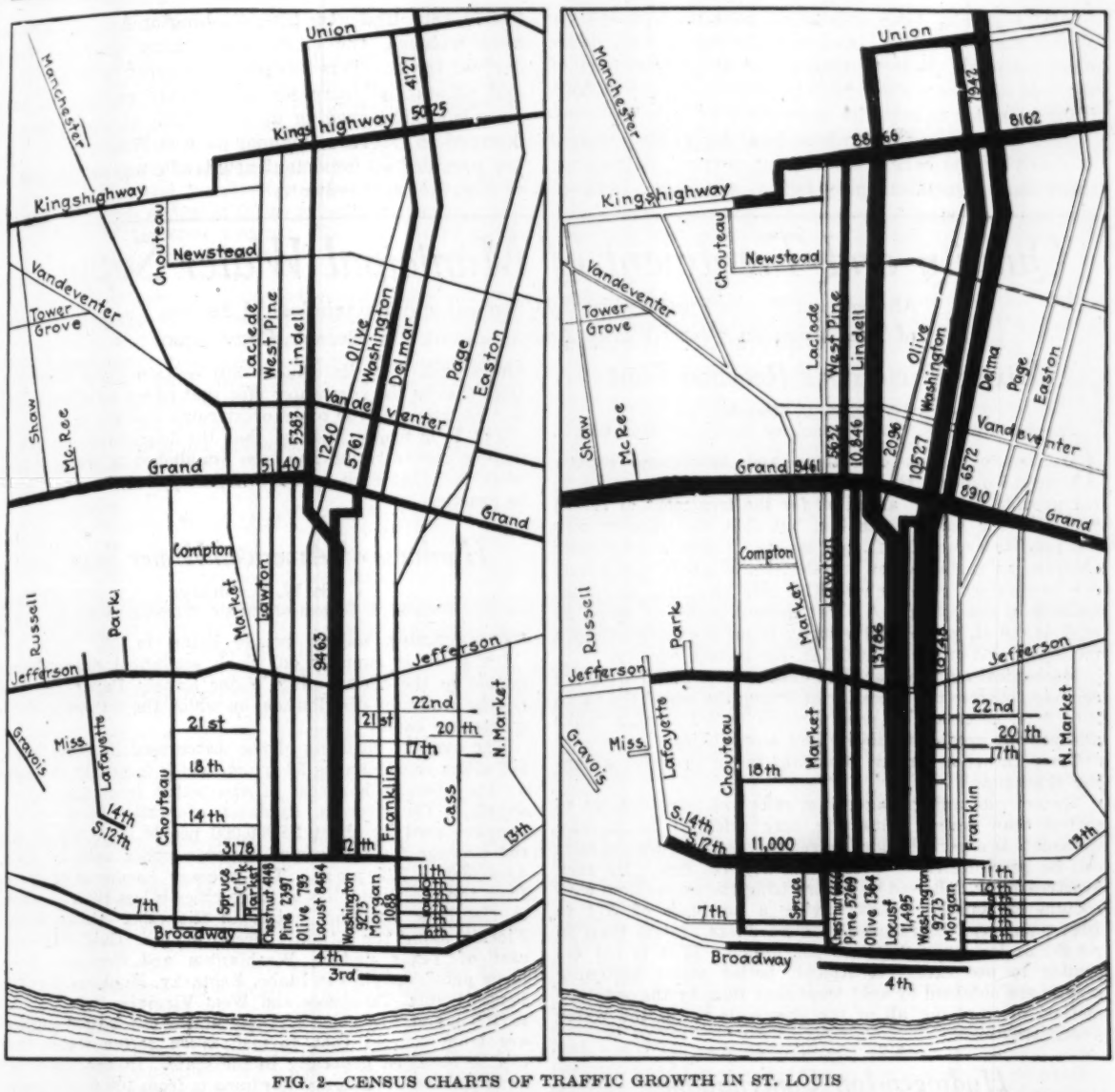


FIG. 2—CENSUS CHARTS OF TRAFFIC GROWTH IN ST. LOUIS

These streets are the direct travel routes from the west. Travel from the northwest and the southwest naturally swings into Grand Ave. and turns east on Chestnut, Pine, Locust, and Washington Sts. In fact, there are no other available routes, the partially diagonal routes are disconnected and inadequate in width and character of paving. As a matter of fact, traffic counts admit no doubt of exactly the situation described.

Since 1916 a traffic census has been kept for the group of streets mentioned. The diagram, Fig. 2, shows the results for 1916, and five years later for 1921. First, both diagrams indicate the concentration of travel on the few east and west streets which penetrate the business section. Second, it is made clear that this traffic in five years has increased to several times its volume in 1916. Incidentally the figures for 1922, which have not been charted, indicate a continuing increase. It is this enormous growth which raises the question, as has already been noted, whether congestion will not be a problem still pressing for solution when the present Major Street Plan is completed.

This plan will relieve congestion, as of present traffic, in two ways: (1) The two radial routes (a) Broadway and (b) the Gravois Ave.-12th St.-Florissant Ave. route, will be made continuous and widened and paved to offer desirable direct routes to the business district from both northwest and southwest; (2) the present narrower east and west streets will be widened and paved to accommodate more vehicles.

Financing the Improvement—The bond issue before mentioned provides the means for carrying out the Major Street Plan. In St. Louis, by charter, costs of street widening are distributed for every project in three ways: (1) Upon the frontage opened or widened, (2) upon a district deemed to be benefited by the improvement, and (3) upon the city at large. The actual distribution of cost varies in every project, and is determined by a special commission of three appointed by the Circuit Court. In every case there is a certain percentage of the cost assessed against the city as payment for a city-wide benefit. The bond money will provide the city general fund for the work proposed by the Major Street Plan.

At the present time ordinances have been passed for approximately 75 openings and widenings in accordance with the plan. It is estimated that the city's share of the cost of these projects will be somewhat over $6,000,000. In order to expedite acquisition of title and completion of improvements, where legal delays are involved in realizing the benefit assessment portion of the cost, there has also been provided a revolving fund of $2,500,000. Under the plan Washington Ave. has already been widened, the city's share being provided from current funds. This has produced great relief to traffic and substantial increases in property value have been recorded. The opening up of S. 12th St. to Lafayette, financed in the same manner as was Washington Ave., has provided an important new traffic way as the charts of Fig. 2 clearly indicate.

Quality and Treatment of Municipal Water Supplies

Abstracts of Papers Presented to the Chemical and Bacteriological Section of the American Water-Works Association at Its Recent Convention

Mixing Devices and Reaction Time

By Charles P. Hoover
Chemist-in-Charge, Water Purification Plant, Columbus, Ohio

Results of plant operations and laboratory experiments indicate that velocities of 0.3 ft. per second do not provide sufficient agitation for the treatment of turbid water or for water softening, but that the velocity does not need to exceed 0.6 ft. per second. Coagulation results obtained on turbid water at velocities of 0.6 ft. per second can be obtained at lower velocities only by adding an excess amount of coagulant. A short mixing period of 20 or 30 min. at 0.6 ft. per second velocity is more effective than a mixing period of 1½ hr. at 0.3 ft. per second velocity.

Mechanical agitators are less expensive to build, are more compact, obviate the necessity of lifting the water the extra 2 or 3 ft. necessary to pass through baffled maxing tanks and provide greater flexibility and accessibility.

Temperature is a more important factor in water softening than time.

Waters containing magnesium salts are more difficult to soften than water containing only calcium; magnesium carbonate is especially hard to remove, but magnesium salts can be precipitated by overtreatment with lime. By such overtreatment, followed by neutralizing the excess lime with sodium carbonate, waters having a hardness of 572 to 1044 p.p.m. can be reduced to a hardness of less than 30 p.p.m., or less than 2 grains per gallon. If it is not desirable to use excess treatment, better water softening results are obtained by split treatment than by the ordinary method of applying all of the chemicals to all the water under treatment.

* * *

Hydrogen-Ion Concentration and Alum in Filter Effluents

By William D. Hatfield
Superintendent of Filtration, Highland Park, Mich.

Results of numerous tests on the water of Lake St. Clair before and after filtration through the purification plant at Highland Park, Mich., have been analyzed for alum content. The following is a summary of the conclusions reached:

(1) Curves plotted according to the Clark's pH-time method from data obtained by treating Lake St. Clair water with alum show an apparent iso-electric point for aluminum hydroxide under these conditions at 6.1 or 6.3 pH units.

(2) Curves are given in the paper which show that in filtration the effluents from alum-treated waters are practically free from all the aluminum added as alum when the pH value of the treated water lies in the zone between 5.9 and 7.5 pH units. Mechanical filtration plants operating within this zone will probably not only remove all the added aluminum but also some of the aluminum naturally dissolved in the raw water.

(3) A water which has been under-treated with alum and has a pH value of more than 7.5 may have a solvent action on the floc in the sedimentation basin and on the filters such that the effluent will contain more aluminum than that in the raw water plus that added as alum. This is probably also true of an overtreated water.

(4) It is firmly believed that the importance of hydrogen-ion concentration has been established in water-supply work and that each year it will be applied more and more to practice.

* * *

Hardness of American Water Supplies

By W. D. Collins
With U. S. Geological Survey, Washington, D. C.

Thirty-nine million people living in 307 cities use the water supplies on which analytical data are reported in the forthcoming Water Supply Paper 496 now nearly ready for distribution, on which the following statements are based.

The average hardness of the water used by those in the 307 cities considered is 99 p.p.m. which is nearly the same as the average hardness of the water from the Detroit supply. The average hardness of water from surface supplies used by about 35,000,000 people is 85 p.p.m. and the average for the ground water supplies used by about 4,000,000 is 225 p.p.m. The average hardness of water from the public supplies of large cities is less than 55 p.p.m. in the New England states, in the other states except Florida along the Atlantic Ocean and the Gulf of Mexico east of Texas and in Washington and Oregon. From large public supplies in Idaho, Kentucky, Montana, Nevada, Pennsylvania, Tennessee and West Virginia, it is from 56 to 100 p.p.m. In some of these states the larger supplies are from sources that furnish much softer water than can be obtained generally in the state. In the states not named above the average hardness is from 100 to 500 p.p.m. About 3,500,000 people use water from Lake Michigan which has a hardness of about 130 p.p.m. The water is softened at several cities in the Mississippi drainage basin. Throughout this area and in the Southwest the hardness of the water of public supplies is generally between 250 and 350 p.p.m. except in the cities using water from the Great Lakes or from mountain streams, and in the cities where the public supply is softened.

* * *

The Pharmacology of Drinking Water

By Herbert C. Hamilton
Pharmacologist with Parke Davis Co., Detroit, Mich.

The most important feature in connection with mineral waters is that for one reason or another larger quantities are imbibed than of ordinary water. This is due partly to the pleasant or characteristic taste, partly to the routine prescribed by the physician and partly to the users giving themselves up to the course of treatment and making the most of it. Probably all the good of mineral waters would result equally from the similar use of any water but this should not detract from the use and exploitation of the mineral water for those who can afford it. The psychology of the treatment really requires a mineral water. The ascribing of mysterious virtues to

mineral water is without basis, neither is the use of it at the springs instead of at home essential for developing its medicinal value. But scarcely indeed will the use be continued under the best conditions unless under the direct control of the attendants. Often, too, climatic and hygienic conditions are more nearly ideal at the springs and of no less importance than the water itself.

Broadly, to make water satisfactory for drinking requires only bacterial purification unless some absorbable poison is present, and most forms of purification are aimed at reduction of bacterial content. But hard water makes soap so insoluble that in some localities hardness is no less important than the bacterial content.

We may conclude that any adventitious circumstance under which water is used or any peculiar property actual or imaginary which will encourage a greater use of water, either internally or externally, is not to be underestimated in its bearing on health and, further, that few substances occurring in a natural water render it unfit for drinking purposes except the presence of pathogenic organisms responsible for intestinal diseases such as typhoid or dysentery.

* * *

Chlorine to Assist Coagulation

By Robert Spurr Weston
Consulting Engineer, Boston, Mass.

Owing to difficulties in operating the water purification plant at Exter, N. H., namely the choice between the evils of under-coagulation with inadequate purification or over-coagulation with corrosion, the accumulations of slimy coatings and mud balls in the filter sand, the high precentage of wash water and the at-times unpleasant vegetable taste of the filtered water, various expedients were tried. Prechlorination to assist coagulation seems to have given the best results.

The water is of the peaty type, soft, colored, sometimes turbid and always difficult to treat even with good mixing and an unusually long period of coagulation. The difficulties were increased following the raising of the reservoir dam in 1909 and again in 1916, thereby flooding additional unstripped areas. The average analytical results during 1913, when the water was treated with an average of 32.6 p.p.m. of sulphate of alumina, or nearly 2 grains per gallon, indicate a reduction in parts per million in color from 80 to 27, of iron from 0.84 to 0.30, turbidity from 16 to 3 and bacteria at 20 deg. C. from 408 to 39 per cubic centimeter.

At first, the bleach, mixed with alum solution, was applied in amounts equivalent to 1 p.p.m. of available chlorine. Later the dose was reduced to less than 0.6 p.p.m. It was found that the addition of 0.7 p.p.m. of chlorine effected the following change in the character of the effluent:

TABLE I—SIGNIFICANT RESULTS OF ANALYSES OF FILTER EFFLUENT WITH AND WITHOUT THE CHLORINE

	P.P.M.	
	Dec. 30, 1913	Feb. 3, 1914
Chlorine added	None	9.7
Turbidity	2.0	1.0
Color	15.0	1.0
Oxygen consumed	3.68	1.38
Nitrogen as albuminoid ammonia	0.170	0.034
Nitrogen as nitrites	None	None
Iron	0.22	0.10
Increase in chlorine	None	0.28
Bacteria per c.c. at 20 deg. C.	45	6
Bacteria per c.c. at 37.5 deg. C.	6	1

Subsequently chlorine gas was substituted for bleach, and the average dose decreased to 0.6 p.p.m. or less. This has been the only modification in eight years. However, the better purification decreased the amount of organic matter in the effluent and consequently the amount of water accumulating on the insides of the services. To reduce the increasing corrosive effect, soda was added whenever the alkalinity was low, thereby decreasing the pH concentration. Soda was first added to the reservoir water, but, with the realization of the fact that the best condition for the coagulation of color is one of low pH value, and for the prevention of corrosion one of high pH value, the treatments were separated. Alum and chlorine are now added to the raw water, and soda, when it is necessary, is added to the effluent.

Subsequently, Arthur L. Gammage made the experiments at Belfast, the results of which were published in *Engineering News-Record*, Sept. 7, 1922, p. 391, and the process has been applied by our firm at the Acadia Mills and elsewhere. Recently N. J. Howard has published the results of similar work at Toronto.

There are many plants where this process might be used with advantage, especially those which treat waters of high vegetable and color contents. Chlorine treatment of these waters before coagulation would reduce the amounts of unsaturated organic compounds in the effluent, thereby reducing the liability to the formation of odors and tastes due to compounds between organic matter in the effluent and the chlorine used to disinfect it after filtration.

* * *

The Degasification of Water

By J. R. McDermet
Research Engineer, Elliott Co., Jeannette, Pa.

The material for this paper is based upon the experience obtained in the development of a successful apparatus for the degasification of water. Part of it rests on work in the research laboratory, and part upon results gained in the application of these degasification units located variously over the entire United States, and ranging in capacity from 4,000 to 1,100,000 lb. per hour. Primarily, the apparatus derives its commercial merits from the fact that it is able to prevent corrosion in piping. [Various methods of degasification are next described and commented on.—Editor.]

The Elliott process is one of deaeration rather than degasification since the gases which are to be removed are normally the gases of the air. The apparatus operates through heat interchange, and at the same time is 100 per cent thermally efficient. In its operation the water is first heated to some 25 deg. above the temperature at which it is desired to use it, and then injected suddenly into a region of vacuum, in which the pressure is maintained at a value corresponding to the vapor pressure of the water at the temperature of use. The 25 deg. excess temperature is available as superheat in the liquid to the temperature of the vacuum, and when the water is injected, the heat immediately flashes some portion of the water into steam, evaporating it and disintegrating the rest completely. After disintegration, the water is collected and further passed back and forth over agitating spray pans for contact with the air inside the chamber. The vacuum in the separator chamber is maintained by some form of air-exhausting equipment in series with a condenser, the function of which is to condense and return to the system the vapors and the heat evolved in the boiling process. The cooling water for this condenser is supplied by the water entering the heater on its way to the heater, and the heat, therefore, interchanged by the condenser is returned to the heater.

The research laboratory has just completed an investigation on the behavior of the Elliott process upon dissolved carbon dioxide. The results will be forthcoming in a paper before the American Chemical Society, by D. H. Jackson, in collaboration with the present writer. It is possible, however, to summarize the results of this paper in advance by saying that the deaerator, so-called, and as previously described, removes all free carbon dioxide and decomposes approximately 25 per cent of the bicarbonate present, most of which is precipitated, and a small part, approximately 16 p.p.m., remains in solution as calcium carbonate. This percentage value increases slightly with concentration of bi-carbonate. The pH values are changed by deaeration from slightly acid to a decidedly alkaline, the change averaging 2.5 pH. The results were obtained upon water from two surface streams, one in the vicinity of Jeannette, Pa., and the other from Pickering Creek, which supplies a suburb of the City of Philadelphia. The pH values on the raw water for the series of determinations average around 6.7 and the pH on the deaerated samples 9.25.

From Job and Office

Hints That Cut Cost and Time For the Contractor and the Engineer

Tractor-Operated Dredge Pump Cleans Drainage Ditch

By Frank D. Danielson
Village Manager, Hinsdale, Ill.

With a Fordson tractor and 6-in. centrifugal dredge pump, the main drainage and sewer outlet of Hinsdale, Ill., has been cleaned out with a saving of $10,000 to the village over other proposed methods. The main feature is the mounting of the pump on skids on the bank and not on a float in the stream as is usually done.

The outlet ditch runs some seven miles down through the valley known as Flag Creek and empties into the Desplaines River. The part of the stream opposite Hinsdale and for a distance of two miles south had filled

CLEANING SEWER OUTLET WITH DREDGE PUMP
Tractor (at left not shown) is belt-connected to pump mounted on skids and can be reset in 25 minutes.

up with sediment which threatened the proper functioning of the entire drainage system. The village of Western Springs also uses this stream for part of its sewage. Relief was necessary at once and there was no time to spread a special assessment in payment for the work, which was estimated at about $15,000. An experiment was made in which dredging was done by the hydraulic method applied from one side because there was insufficient water to permit mounting the pump on a scow. However, an auxiliary float was used for handling the suction hose. A 6-in. spiral pipe was used for the discharge which was directed for the greater part of the time to the opposite side of the stream. The pump was mounted on skids made from 6 x 8-in. timbers 12 ft. long, with 4 x 6-in. cross supports bolted to the skids.

Sand, mud, silt and stones were readily picked up by the suction force. No agitating device was required; instead, two men, as shown in the cut, used long pole shovels. A third shaped up the sides and a fourth, acting as foreman, operated the tractor and watched the performance of the pump.

This method of dredging from the side of the stream was made possible by the use of flexible suction hose which could be moved along from point to point as the work progressed. A part of the hose rested on a float with the suction end projecting over the front. A 45-deg. elbow was used at the hose end under water. The discharge end had a flap valve, closed when priming, an operation accomplished by means of a threshers' pump. Power, speed, and size of pulleys to be used were matters of study to fit actual conditions.

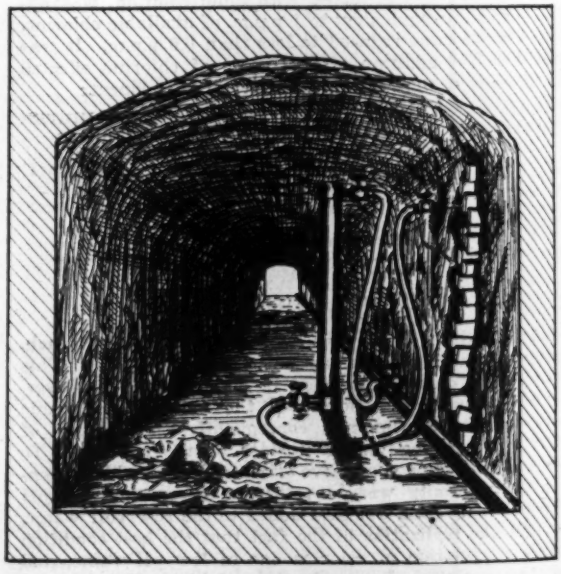
The amount of solid material pumped ranged from 15 to 30 per cent. A stretch of 20 to 25 ft. was cleaned to a depth of 5 ft. below the old stream bottom during each setting of tractor and pump. The time required for a re-setting did not exceed twenty-five minutes. About 2 cu.yd. of material were removed per lineal foot dredged, and a section from 50 to 90 ft. long was completed each day, which made the total cost of removal between 14 and 21c. per cubic foot.

Home-Made Grout Gun Stops Water Flow Into Tunnel

By John L. Digby
Big Creek, Calif.

A troublesome water-bearing seam encountered in heading No. 5 of tunnel No. 3 being driven by the Southern California Edison Co. on the Big Creek hydroelectric project was stopped by grouting with the aid of a simple device made up on the job.

This tunnel is 21 x 21 ft. in section and when the seam was encountered water flowed from it for the full 21-ft. height of the tunnel. The flow was stopped temporarily by calking it with oakum and holding the oakum with wooden wedges driven tightly for the full length of the seam exposed. This emergency method was not expected to be permanent in view of the heavy shooting at the heading a few feet away. To effect a permanent stoppage, therefore, a 1½-in. hole was drilled at an angle to the crack beginning about 2 ft. to one side of it and



APPARATUS FOR GROUTING SEAM IN TUNNEL

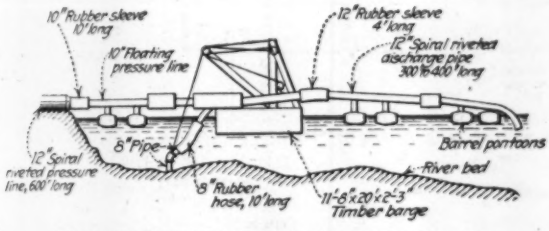
2 ft. below the roof of the tunnel. After drilling 4 ft. this hole struck the water-bearing seam. A 1½-in. pipe threaded on one end was inserted in the hole and calked, leaving the threaded end protruding about 2 ft. Flow through this pipe was stopped by fitting a valve to the threaded end.

In the meantime a 20-ft. length of 6-in. pipe capped and fitted with 2-in. valves was filled with grout and brought into the tunnel. This pipe container was set up vertically near the seam; the lower end was connected by a 2-in. rubber hose with the pipe leading into the seam and the upper end was connected by a similar hose to the main compressed air line supplying the drills and carrying a pressure of 125 lb. per sq.in. When the valves were opened in a very few minutes the 20-ft. length of pipe was emptied of cement—this being determined by tapping on the pipe. The valves were then closed and the pipe removed. Within 24 hours the seam was quite dry and in spite of heavy shots in the heading nearby, some of which used as much as 40 boxes of powder at one time, the seam gave no further trouble.

Moving River Sand by Hydraulic Elevator

BY R. FRANKLIN MUNDORFF
Kansas City, Missouri

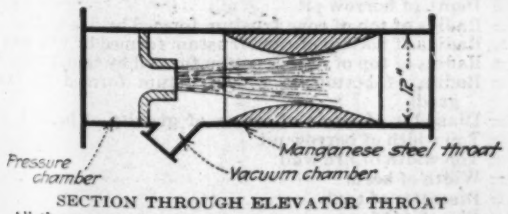
FOLLOWING the construction of a concrete dam at Decatur, Ill., it was desired to pack sand under the edge of a horizontal concrete apron. The particular job presented the problem of moving 18,000 cu.yd. of sand in a river to a new location 400 ft. away in a deep hole in the river bed. Many methods were considered,



HYDRAULIC ELEVATOR MOVES RIVER SAND

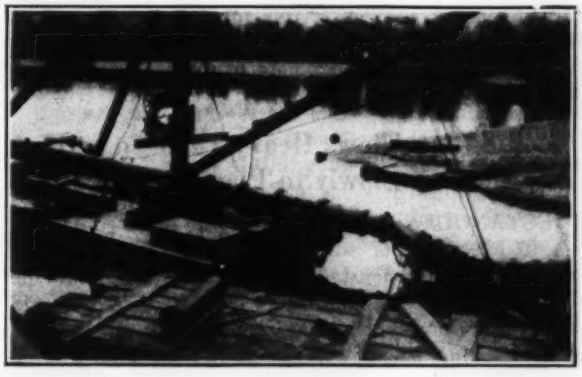
but due to excessive expense and lack of adaptation and flexibility of equipment, were discarded and the hydraulic elevator, pictured herein, finally decided upon. The equipment designed was found to be particularly adaptable inasmuch as there was available sufficient high-pressure water and because a small, inexpensive barge would accommodate necessary equipment and the pumping unit could be mounted on the shore.

The elevator was placed on a small barge and the water pressure line brought aboard on barrel pontoons. This pressure line was fitted with 10-in. by 10-ft. rubber sleeves at both the shore and barge ends. The suction consisted of a 10-ft. length of 8-in. rubber hose and two lengths of 8-in. pipe. This was supported by



SECTION THROUGH ELEVATOR THROAT
All the wear was centered on the manganese-steel throat.

a block-and-tackle extending from a small stiff-leg derrick and was raised and lowered by a hand winch. The discharge line, varying from 350 to 400 ft., was supported also by barrel pontoons. The discharge end of



MECHANICAL ARRANGEMENT OF ELEVATOR
The three flanged sections in front of the derrick constitute the elevator. The nozzle is in the near end of the Y. The suction pipe is operated by the derrick.

the line was submerged in order to eliminate a static head against the elevator.

A large reciprocating pump with valve gear was used to supply the pressure water. Actual results obtained were from 50 to 60 cu.yd. of sand per hour, exclusive of the time used for changing location. The pressure used was 1,670 gal. per minute with a pressure at the pump of 80 lb. per square inch. The pressure at the elevator nozzle was 70 lb. per square inch. The elevator began to pick up sand at 25-lb. nozzle pressure and worked well at 40-lb. pressure, showing no improvement above a 70-lb. pressure.

The installation was made by George B. Massey of the Randolph-Perkins Co., Chicago, Ill., for the city of Decatur.

Concreting Leakage Seams in Small Dam

INGENIOUS handling of difficult problems was involved in the repairs to the Ephratah dam of the Fulton County (N. Y.) Gas & Electric Co., recently undertaken. The repairs were necessitated by leakage through seams in which the bond was weak, and through expansion cracks. The difficulty was increased by the decision to make the repairs from the upper side of the dam.

For the purpose of this undertaking a semicircular caisson 5 ft. across and 20 ft. deep was fashioned out of ¼-in. boiler plate with reinforcement ribs of angle iron bent to fit the caisson, and with a bulkhead at the lower end. To float the caisson from one position to another oil drums were fastened at the top. When the caisson was floated into position against the face of the dam, a 4-in. siphon with 30 ft. of suction head drew the water from the interior. As the water level was lowered the leakage through the sides decreased because of the increased pressure and the resultant closer adherence of the caisson to the face of the dam. A 2-in. siphon took care of the leakage after the water had been practically all drawn off, until this leakage could be prevented by calking the space where the caisson faced the dam.

The leaks in the dam were repaired by cleaning the cracks or seams, building a protecting form over them and pouring concrete into the cracks. The concrete was

allowed to set before the caisson was moved to its next position. Some of the patches were more than 12 ft. in length.

Planking and bolt stubs left in the face of the dam by the builders complicated the work, by making it difficult to seal the caisson. After some experience a 2-in. thickness of felt was applied to the edges of the caisson, replacing strips of rubber hose originally used to prevent seepage.

Melting Ice Allows Heavy Tank To Settle Slowly to Place

RECTANGULAR steel tanks used as brine containers in ice plants of the Union Ice Co. of California are lowered from construction position just above the foundation onto the permanent support with the aid of blocks of ice which carry the weight of the tank while blocking is being removed and then, as the ice

ICE CAKES LOWERING 22½-TON TANK TO FOUNDATION

melts, allow the tank to settle to its foundation. The buildings in which these tanks are installed are not designed with a frame from which the tank could be suspended and the melting ice method has been found cheaper and more satisfactory than erecting temporary means of supporting the tank while lowering it to position.

The foundation prepared before work starts on the tank consists of a concrete slab covered by several inches of cork and surfaced with asphalt. The tank is riveted up on blocking 3 to 4 ft. above this foundation in order that workmen may have access to the under side of the tank during the process of riveting, calking and painting. When the tank is finished the blocks of ice are placed and the tank is lowered on jacks until the ice carries the weight, after which all jacks and blocking are removed and the melting ice allows the tank to settle to final position.

The tank shown in the accompanying photograph has plan dimensions of 33 x 84 ft., is 4 ft. deep and weighs about 22½ tons. Two rows of ice blocks were placed under it on 12-ft. centers and to hasten the melting process small wood fires were built inside the tank, one over each supporting cake of ice.

In the case illustrated, 300-lb. ice cakes whose dimensions were 11½ x 22½ x 42 in. were set on end. More frequently the cakes are set on edge, the 22-in. dimension. The tank can be quickly "jacked down" to this 22½-in. height, which is sufficient clearance for the removal of all blocking. When the ice cakes are on edge there is less danger of slipping or uneven settlement. With the aid of small fires in the tank the 22½-in. thickness of ice is ordinarily melted away in twelve hours.

Data from which the foregoing was prepared were supplied by H. L. Lincoln, superintendent of factories, the Union Ice Co.

From Job and Office

Hints that Cut Cost and Time

Design of Oil Tank Fire Walls

By F. W. Babbitt
American Petroleum Co., Houston, Texas

IN ORDER that a reasonable insurance rate may be secured on oil property, state fire insurance commissioners have laid down certain rules and specifications concerning the construction of tank farms. One of these specifications in Texas and Arkansas is that the cubic capacity inside the fire wall shall be one and one-half times the cubic capacity of the oil tank. Fire walls of course are a necessity, for with them fires, which may break out, can then be more easily controlled locally. As fire-wall design, to meet these conditions, is tedious, the writer has prepared two sets of formulas, given herewith, the first dealing with estimation of

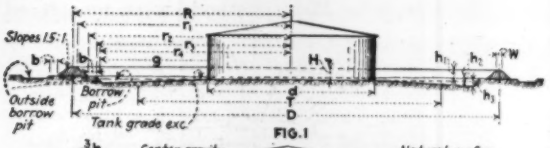


FIG. 1

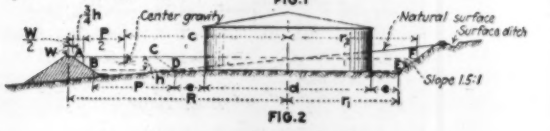


FIG. 2

quantities where a tank is located on level ground, and the second a case in which the tank is on a side-hill location.

For location of a tank on level ground (see Fig. 1) the following elements are involved in the fire-wall design:

Q = Cu. ft. inside of fire wall = contents of tank + 50%
Q_1 = Cu. ft. in cone frustum formed by fire wall
Q_2 = Cu. ft. in cone frustum formed by tank grade
Q_3 = Cu. ft. in borrow pit to complete fire wall
G = Cu. ft. in fire wall
D = Diameter of center line of fire wall
R = Radius of fire wall
H = Height of top of fire wall above tank grade
h_1 = Height of top of fire wall above ground line
h_2 = Depth of tank grade below ground line
h_3 = Depth of borrow pit
r_1 = Radius of top of cone frustum formed by fire wall
r_3 = Radius of bottom of cone frustum formed by fire wall
r_2 = Radius of top of cone frustum formed by tank grade
r_4 = Radius of bottom of cone frustum formed by tank grade
T = Diameter of circle of center of gravity of borrow pit
g = Top width of borrow pit
w = Top width of fire wall
b = Width of berm
d = Diameter of tank
π = Pi = 3.1416

From Job and Office

For Contractor and Engineer

The formulas which have been derived to establish the values of the foregoing elements are:

$$Q = Q_1 + Q_2 + Q_3$$

$$G = Q_2 + Q_3 = D\pi[h_1(1.5h_1 + w)]$$

$$Q_1 = \frac{h_1}{3}\pi(r_1^2 + r_2^2 + r_1r_2)$$

$$Q_2 = \frac{h_2}{3}\pi(r_3^2 + r_4^2 + r_3r_4)$$

$$Q_3 = T\pi h_1 \times \frac{g}{2}$$

$$h_1 = \frac{3(Q - G)}{\pi(r_1^2 + r_2^2 + r_1r_2}$$

$$h_2 = \frac{2Q_3}{\pi g T}$$

$$r_1 = R - \frac{w}{2}$$

$$r_2 = R - \left(1.5h_1 + \frac{w}{2}\right)$$

$$r_3 = r_2 - b$$

$$r_4 = r_3 - h_2$$

$$g = r_4 - \frac{d}{2}$$

$$T = \frac{4}{3}(g - 0.5h_2) + d$$

For locations of tanks on side hills, design is based on the following quantities:

Q = Cu. ft. inside fire wall = Tank contents + 50%
R = Radius of fire wall
d = Diameter of tank
h = Height of top of fire wall above tank grade
e = Distance from edge of tank to toe of slope in cut
r_1 = Radius of bottom of cone frustum *CDEF* (Fig. 2)
r_2 = Radius of top cone frustum *CDEF*
P = Long side of parallelogram *ABCD*
C = Radius of half circle made by center of gravity of parallelogram
w = Top width of fire wall
$\pi = 3.1416 = \text{Pi}$

Formulas to determine the values of the foregoing quantities are:

$$Q = \frac{h}{3}\pi(r_1^2 + r_2^2 + r_1r_2) + \pi PhC$$

$$h = \frac{3(Q - \pi PhC)}{\pi(r_1^2 + r_2^2 + r_1r_2)}$$

$$r_1 = \frac{d}{2} + e$$

$$r_2 = r_1 + 1.5h$$

$$P = R - \left(\frac{d}{2} + e + 1.5h + \frac{w}{2}\right) = R - (r_1 + \frac{w}{2})$$

$$C = R - \left(\frac{P}{2} + \frac{3}{4}h + \frac{w}{2}\right)$$

SHORT CUTTING FIRE WALL DESIGN
DIMENSION TABLE — LEVEL LOCATION

		55,000 Bbl. d = 114.6 Fire Wall Diameter				37,500 Bbl. d = 95.5 Fire Wall Diameter			
	Dimensions	310 ft.	300 ft.	290 ft.	280 ft.	270 ft.	260 ft.	250 ft.	240 ft.
Case 1	G, cu.yd.	2,503	2,723	2,947	3,147	1,928	1,977	2,143	2,303
	h_1, ft.	5.7	6.0	6.4	6.8	5.1	5.5	5.8	6.2
	b_2, ft.	0.8	1.0	1.0	1.2	0.8	0.8	1.0	1.0
	h_2, ft.	1.2	0.7	1.2	1.4	0.8	1.1	1.2	2.0
	H, ft.	6.5	7.0	7.4	8.0	5.9	6.3	6.8	7.2
	W, ft.	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
	b, ft.	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Case 2	G, cu.yd.	2,893	3,371	3,461	4,079	2,118	2,427	2,737	3,119
	h_1, ft.	6.1	6.8	7.2	7.9	5.5	6.1	6.7	7.4
	b_2, ft.	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.4
	h_2, ft.	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
	H, ft.	6.6	7.3	7.7	8.4	5.9	6.5	7.1	7.8

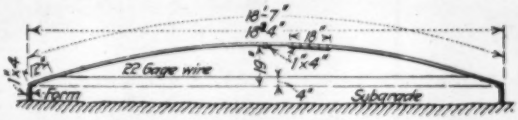
A dimension table reproduced herewith has been computed on the basis of the fire wall containing contents of the tank plus 50 per cent. This table gives fire-wall diameters and other dimensions for tanks on level ground. The table is worked out for tanks containing 55,000 bbl. (42 gal. each) and for 37,500 bbl. and for two cases, one wherein ample drainage is presupposed and all material for the fire wall is taken from within the wall. The second case is one wherein poor drainage is present and the least amount of excavation possible is performed to provide a tank grade and drainage for the tank. The material necessary to finish the fire wall in case two is taken from the borrow pit outside.

In using formulas given herewith there will be too many unknown quantities to arrive at definite results at the first computation. The second or third trial should balance the contents of the tank plus 50 per cent and the fire wall within a few hundred barrels, which will be close enough.

Sunshade for Protecting Freshly Laid Concrete Paving

By F. M. Bailey
Engineer-Inspector, Wisconsin Highway Commission

A LIGHT, inexpensive sunshade for protecting freshly-laid concrete has been designed by the Wisconsin Highway Commission. The 1923 specifications included the use of frames to cover at least one-half day's run as fast as the surface is finished. The framework is constructed from 1 x 4-in. and 1 x 3-in. strips, ¾ in. thick. The 1 x 3-in. strips are used for the ribs, five ribs spaced on 3-ft. centers making a frame to cover



SUNSHADE FRAME FOR CONCRETE PAVEMENT

12 ft. of road. The splice is made from the piece cut off from the end of one 10-ft. strip and is nailed to the underside of the ribs, the nails being clinched. The longitudinal strips to which the ribs are nailed with four nails clinched are 1 x 4 in., 12 ft. long. The framework can be nailed together on any flat surface and the sheeting tacked to the surface before the ribs are sprung. Holes ¼ in. in diameter are drilled through the ribs 1 ft. from the outer edge of the 1 x 4-in. strip, through which the wires are passed to form the lower chord and sustain the arc in the ribs.

These frames can be made up at any convenient point and transported to the job flat. When ready to use, the wires are threaded through the holes, the arc in the ribs sprung and the wires twisted up. When necessity requires the transportation of the covers from one job to another, the wires are untwisted which allows the frame to flatten.

Material for a frame consists of 37 ft. b.m. (about $3) of lumber; 25 yd. of unbleached muslin at $4.50; and 10 cents worth of wire.

As these frames are light two men can move them along as the paving proceeds. Where strong winds prevail, it may be necessary to use screw-hooks at the edges to fasten them to the forms so that they will not be blown out of place.

Current Concrete Costs on Concrete of Reclamation Service

COSTS of concrete per cubic yard on work under way this last summer season on some of the U. S. Reclamation Service projects as taken from current cost reports are as follows:

Project	Feature	Cu. Yd.	Unit Cost Field	Unit Cost Total	Class of Concrete
Blackfeet	Drop Four Horns Reservation	565	$23.10	$30.00	Reinforced
King Hill	Relief drainage structure	89	22.62	26.60	Reinforced
No. Platte	Checks, North Port	82	21.40	25.00	Reinforced
Rio Grande	Checks and wasteway	125	19.53	23.75	Reinforced
Tieton Dam	Corewall	4,992	17.97	22.10	Reinforced
Riverton	Diversion dam	2,007	24.40	29.30	Reinforced
Riverton	Diversion dam	4,046	10.38	12.50	Plain
Yakima	Corewall	7,785	12.60	15.50	Plain

Two Types of Portable Grandstands

A NEW portable grandstand has recently been developed by the Department of Plants and Structures of New York City. The framework of the stand is built

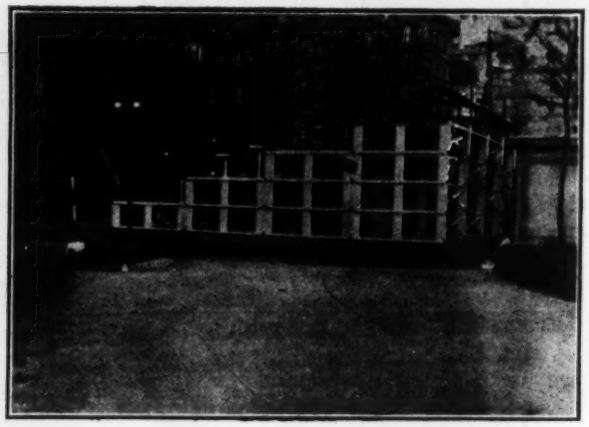


FIG. 1—PORTABLE GRANDSTAND OF DEPARTMENT OF PLANTS AND STRUCTURES, NEW YORK CITY

of structural steel units 5 ft. long and 1 ft. 5 in. high. Fig. 2 illustrates the method of assembling the units to form the risers of the stand. Car bolts are used to fasten the sections together. Longitudinal sway braces

FIG. 2—DETAILS OF NEW YORK STAND

Two of the intermediate platform steps are in the foreground. The position of one of these steps can be seen between the bench supports just at the left of the tree.

From Job and Office

Hints that Cut Cost and Time

of 1¼ x 1¼ x 1¼-in. angle iron are bolted in between opposite panels of adjoining risers as the stand is erected. The risers are spaced 5 ft. apart. The flooring of the stand is made up in sections 1 ft. 8 in. wide and 10 ft. long, secured to the risers by clips which extend

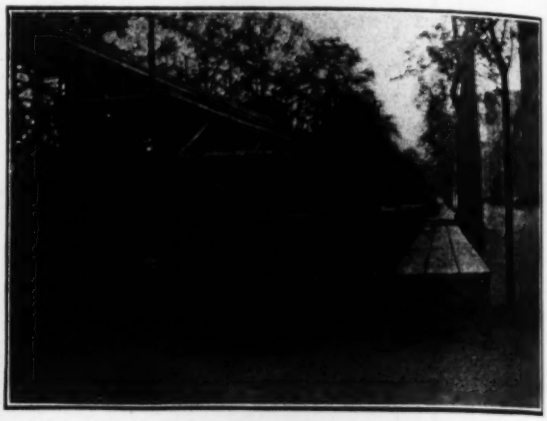


FIG. 3—PORTABLE GRANDSTAND OF WAYNE IRON WORKS

under the flange of the top angles of the riser frames. The seats are supported on pipe pedestals bolted to the floor sections.

Fig. 3 shows a section of a patented portable stand built by the Wayne Iron Works. The units of this stand are horizontal sections of the square tower, each section being interlocked with the one below it. Special sections with an extension arm spanning the space to the tower in front of it carry the alternate levels of the platform. Each section is hinged at the corners in such a way that it can be folded up for storage.

A comparison of the two types of stand seems to favor the new stand of the Department of Plants and Structures, in so far as its usefulness as a stand goes. It is much less liable to collapse, and provides clean seats separate from the platform. The Wayne Iron Works stand is more economical of steel and as almost no bolting is necessary it can be erected and taken down with much greater ease.

Mess Costs per Man per Day on Reclamation Projects

THE following tabulation shows the cost of operating messes during the summer of 1922 on projects of the U. S. Reclamation Service:

Project	Location	Haul Miles	Man-Days	Cost per Man-Day
Flathead	Hubbard Dam	16	1,657	$1.04
Grand Valley	Camp 5	12	141	.86
King Hill	Camps B, C, and D	10	746	1.18
Klamath	Langell Valley	45	3,363	1.32
No. Platte	Interstate & No. Port	6	1,454	1.20
No. Platte	Fort Laramie	13	1,461	1.19
Riverton	Diversion Dam	38	1,048	1.16
Shoshone	Willwood and Shoshone Dams	13	1,448	1.47
Yakima	Tieton Dam	26	8,787	1.17

From Job and Office

For Contractor and Engineer

Ice Action and Corrosion Destroy Old Standpipe

ON APRIL 9 the water-works standpipe at Black River Falls, Wis., failed by breaking off at a point about 25 ft. above ground. This standpipe was 16 ft. in diameter and 100 ft. high. The plates, as near as one could judge, were from ¼ in. to ⅜ in. thick. This standpipe was erected in 1886.

The direct failure of the standpipe was probably due to ice formation. On Saturday, two days before the failure, the superintendent reports that the cake of ice rose 8 to 10 ft. above the top of the standpipe and remained there most of the time while he was pumping. Saturday night the temperature got somewhat colder, and after the water receded in the standpipe the ice also receded from view. On Sunday, when the standpipe was again filled, the superintendent was unable to make the ice float and show up above the top of the standpipe, although he overflowed the standpipe for a considerable time. Sunday night the temperature became warm again, and on Monday morning, when it was still quite warm, pumping began at about 6.45 a.m. The warm water thawed loose the enormous cake of ice, which must have been in the neighborhood of 90 ft. in height and 3 to 4 ft. in thickness all around the periphery of the standpipe. At 7.30 the standpipe failed.

At just what point this ice cake happened to be frozen to the standpipe is not known, so that it is impossible to say whether the cake first sank or whether it rose when it became loosened from the standpipe, but it must have moved in one direction or the other, and the impact was enough to start the failure. Persons who saw it said the standpipe swayed back and forth for a considerable time before it finally collapsed.

The standpipe fell to the south. The particular reason for its breaking off 25 ft. above the ground may lie partly in the fact that the bottom four rows of plates were thicker metal and had a greater resistance to the stresses produced by the ice.

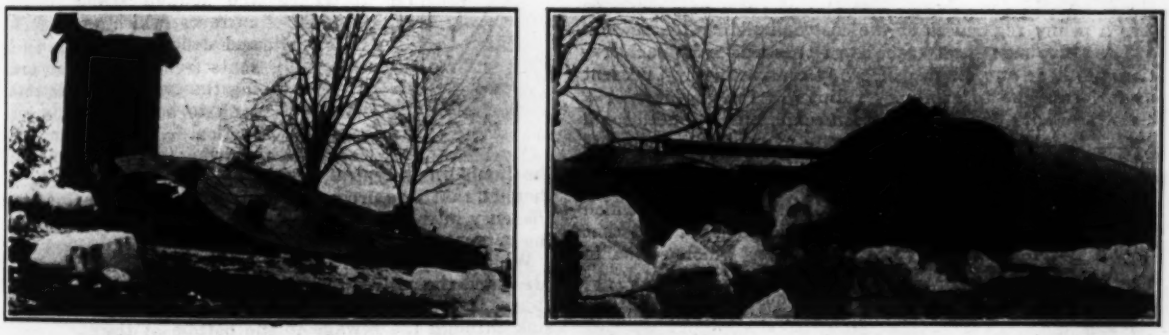
There is another feature of this failure that is extremely interesting. This standpipe was painted but once, and that was when it was first put up, so that corrosion has taken place on the inside for 37 years. The water used in this system is a creek water, and is very soft and contains much organic matter.

INTERIOR OF CORRODED SHELL, GROOVED VERTICALLY

A careful examination of the inside of the standpipe revealed the fact that the plates near the top were little damaged by pitting or other corrosion, but nearer the base more and more pitting appeared until finally the pits seemed to follow in channels, so that at the point of rupture the plates were furrowed as by a planer. Undoubtedly, when the water receded between pumpings drops of water collected and slid down the plates, the carbon dioxide in the water combining with the iron, continuation of this process picking up more iron and furrowing deeper and deeper into the plates. At some places the remaining metal of the standpipe was less than ¼ in. thick and appeared to be greatly laminated.

In the views of the standpipe are shown some very large wooden blocks attached to its upper portion. These blocks originally supported a wooden balcony.

The city is now using the 25 ft. of standpipe for storage and pressure. A new elevated tank or standpipe is to be erected. W. G. Kirchoffer, of Madison, Wis., consulting engineer to the city on this and other water-works improvements, furnished the above information on the failure.



BLACK RIVER FALLS STANDPIPE AND FRAGMENTS OF THE ICE CAKE WHICH CAUSED ITS FAILURE

Letters to the Editor

This department aims to be a forum for the discussion of the views of engineers and contractors. The range of interest should be as wide as possible. Contributors are, therefore, asked to make their letters short.

Constructive Criticism Needed

Sir—I am pleased to endorse your editorial on page 1029 of *Engineering News-Record* of June 14, 1923, which takes the position that a constructive criticism of the plan of railroad consolidation is much to be desired. It was my pleasure to attend the general hearings in Washington during which the tentative plan of the commission was discussed, and I am satisfied of the correctness of your position that this subject needs much study and discussion. A complete scientific investigation of this problem will require much additional time.

Washington, D. C.
June 19, 1923.

EDWIN F. WENDT,
Consulting Engineer.

Louisville Sewer Contracts and Arbitration

Sir—Referring to the editorial in *Engineering News-Record*, June 14, 1923, p. 1030, it seems that some explanation should be made.

Six contractors have signed written assertions about the methods our engineers employ. Of these six only three have ever done work for us, one has never submitted a bid. One of the original objectors after reading a reply to his assertions has recognized the justice of our position by recently making bids, one of which was under our engineers' estimate of cost.

The Commissioners of Sewerage of Louisville are four of the leading business men of the city, two of whom are Democrats, and two Republicans, the mayor being an additional ex-officio member. Not one of them can made or lose a penny regardless of the cost of building the sewers.

These five men have agreed to sit as a board of arbitration and hear any claim which any contractor may present as to losses due to arbitrary rulings of the engineer or a claim in equity due to unforeseen conditions and additional work. It is significant that in spite of general statements made by two contractors not a single claim for compensation has been presented to the commission for adjudication.

They have not tested out the arbitration clause which they now have. Further, the commission has not said that it will not arbitrate any specific matter which seems to warrant it, but it has refused to delegate to outside parties the responsibility placed upon it by the city of Louisville.

The commission does demand and expects to continue to demand that sewers be laid to line and grade and that they be of the material and of the quality set forth in the specifications. No claim has been made that it has ever demanded anything not set forth in the contract drawings and specifications placed in the hands of the contractors before they made their proposals.

Losses have been claimed by contractors. Our cost figures show on two contracts that the excavation did cost more than the prices bid. No claim that our inspectors have been arbitrary in their rulings can be substantiated regarding these losses.

Another loss is claimed because selected earth was required to be put immediately over the masonry in accordance with the specifications. This contractor was urged to put his rock on one side of the trench and his earth on the other in order that the selected earth would be available to place over the sewer barrel. No attention was paid to this suggestion and when backfilling was commenced the earth which under the specifications must go in first, was covered with rock and some difficulty was experienced in getting to the earth. The engineer was as liberal in this matter as the specifications permitted.

Another claim was that an underdrain was not continued throughout the entire length of the trench and that this cost the contractor money. We are ready to adjudicate this claim, whenever the contractor sees fit to present it, on the basis of equity in spite of the fact that the engineer's estimate of quantity clearly indicated that only one-half the length of the sewer would have an underdrain.

It is our intention to build the best sewers that can be built. Contractors know that we insist on high class workmanship and should take this into consideration in making their proposals.

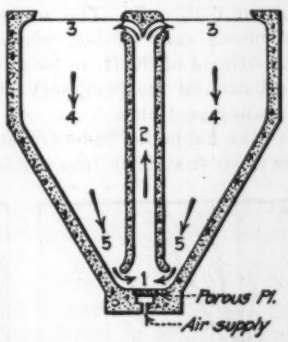
P. H. HOGE, JR.,
Secretary and Treasurer, Commissioners of Sewerage of Louisville.

Louisville, Ky.
June 20, 1923.

A Proposed Variation of Activated Sludge

Sir—Dr. Buswell's article in *Engineering News-Record*, May 10, 1923, on the "Importance of Oxygen and Stirring for Activated-Sludge Growth" is very interesting and suggestive. This article and your editorial upon it remind us of the wastefulness of present activated-sludge methods in the use of compressed air, and re-open the subject of what can be done to eliminate this waste.

Some very convincing evidence is brought forward by Dr. Buswell in support of his conclusion that activated sludge will grow at low oxygen levels, and that the principal useful result we accomplish by the liberal use of air in the activated-sludge process is the stirring of the sewage and the holding of the sludge in suspension. Assuming that this conclusion is correct, and granting that compressed air is a convenient agent for stirring the sewage and elevating the floc, the question arises as to whether our present method of utilizing air for these purposes is the most efficient that can be devised. When air is forced in quantity through a porous plate at the bottom of an ordinary tank of sewage, it generates in the sewage strong upward currents which are opposed and deflected by return currents from the surface, causing the contents of the entire tank to be thrown into commotion. In watching the whirling and eddying of the liquid in a typical activating tank, one is led to the thought that this process is destructive of energy, and that efficiency in the use of air would be promoted by controlling the currents which are generated.



While studying over this subject, the following ideas have presented themselves to the writer: (1) If a portion of our object is to elevate the floc to counteract its tendency to sink through the sewage to the bottom of the tank, would it not be advantageous to do this by continually gathering the sewage rich in floc from the lower part of the tank and raising it quietly and efficiently to the upper part of the tank by means of an air-lift? Reason tells us that this would require less air than the agitation process with its conflicting and opposing currents. (2) If the remainder of our object is to bring each particle of the floc into intimate contact with successsive portions of the surrounding aerated sewage, could we not accomplish this by other means than violent stirring? Would not the same result be secured by allowing a continual supply of floc particles to settle under their own weight through a region of quiescent aerated sewage?

For carrying out these ideas, the arrangement of tank and air-lift shown in the figure has suggested itself. This arrangement provides for the circulation of the sewage through a series of zones, the action proposed for each zone being as follows:

(1) Zone of Aeration: Here the sewage is intimately mixed with finely divided air rising from the porous plate. Each particle of floc is surrounded by tiny eddies generated by the rising bubbles. These eddies sweep away the by-

products of biologic growth, diffuse the oxygen absorbed, and bring the dissolved, colloidal, and suspended organic matter into close contact with the floc particles.

(2) Air-Lift Zone: Aerating effects are continued. Mixture of air, sewage, and floc rises at velocity of greatest air-lift efficiency. Large eddy-currents, impacts, and short circuiting of flow cannot occur.

(3) Air-Releasing Zone: Mixture of air bubbles, sewage, and floc spreads out on surface of tank while air is being released.

(4) Settling Zone: Floc particles settle downward through quiescent sewage, growing in size and firmness, and sweeping from the sewage its dissolved, colloidal, and suspended organic matter.

(5) Collecting Zone: Settling sludge is here collected and directed toward the entrance of the riser. Concentration of sludge particles to the exclusion of oxygen-bearing water is prevented by constant withdrawal from below.

The above proposals for securing economy of air in the activated-sludge process seem to offer an interesting field for study and experiment. As a help in planning such experiments, any suggestions or criticisms by others who have been working along similar lines would be appreciated by the writer.

HAROLD A. THOMAS,
Professor of Hydraulic Engineering,
Rose Polytechnic Institute.

Terre Haute, Ind.,
May 14, 1923.

Clay Brick Interests Criticise Tests

Sir—Because the comparative tests of clay and concrete brick piers made recently by Columbia University were conducted under conditions which differ widely from current practice in the field, the Board of Directors of The Common Brick Manufacturers' Association of America, on June 12, unanimously rejected the test results as recently published by Columbia University (*Engineering News-Record*, May 31, 1923). The United States Bureau of Standards was also asked to conduct at the earliest possible moment comparative tests on clay and concrete brickwork so that the construction industry might have the truth as to the real properties of each kind of material.

Taking up the report in detail, in the first place mortar was used which is not comparable to that employed in ordinary construction. Although the tests were made upon brickwork supposed to represent New York City practice, the mortar was 1:3 portland cement mortar. The report does not state that any lime whatever was used in this mortar, and presumably there was none. The New York Building Code, however, specifically permits a certain percentage of the cement in cement mortar to be replaced by lime and this is typical of building codes throughout the land. This provision is intended to allow the use of a much more practical mortar than 1:3 cement mortar could possibly be. I doubt whether any reader of *Engineering News-Record* has ever put through a complete job using pure cement mortar without any lime in it. Such mortar works "short," and requires much greater time for the laying of a piece of brickwork than where the usual percentage of lime is used. It would be an extremely difficult, if not impossible, matter to get such mortar employed. The saving to the contractor in material and in bricklayers' time and the better grade of work resulting from the addition of lime to cement mortar presents such a powerful combination of reasons for the contractor to use it that only the most vigilant and constant inspection could insure the type of mortar used in this series of tests. Why was not mortar used comparable to that employed in actual construction?

Again, I would draw the attention of those of your readers who are practical masons or who are familiar with practical work to the illustrations of the typical fractures of test specimens shown on pp. 960-961 of the article of *Engineering News-Record*. Again, I would be content to leave it to the good judgment of these men as to whether, with a pure cement mortar mixed in the proportion of one part of portland cement to three parts sand, they ever, in the whole course of their experience, saw brickwork laid up with such full and perfect joints as those shown in the illustration. You will note that every joint is absolutely full of mortar, in spite of the fact that cement mortar works "short." The following, however, is quoted from the report: "The joints were struck off flush, and no special care was taken to produce other than a good grade of common brick masonry."

Your readers will also recall that it is much simpler to apply plaster or stucco to a brick wall than to concrete and that the bond between brick and the plaster or stucco is almost always good. We are invited to believe, however, that, where the concrete surface is a brick and the mortar is in the form of a mortar joint, by some mysterious means a better bond is secured than with a real brick. Possibly the following extract from the report may have some bearing upon this very extraordinary conclusion: "After construction they (the piers) were sprinkled daily with water for about one week." Has any mason contractor reader of this paper ever sprinkled a wall daily for one week after he has built it?

It is a fact also that concrete brick are much harder to lay than real brick, owing to the thin film of cement which forms their outside surface and which causes them to slide on the mortar bed. The bricklayer has to spend considerable time keeping the wall in line and nursing it along and this condition is aggravated in cold weather. This may be the reason why these brick, according to the report, were laid dry and may also have some bearing on the fact that the piers were afterward sprinkled daily.

The common brick industry now submits that in all fairness a series of tests be conducted under conditions comparable to those found in actual construction upon piers of the same size as those recently tested in Columbia University, to be made by an impartial and competent laboratory, preferably that of the United States Bureau of Standards; that the selection of the material and building of the piers be done under the supervision of competent engineers, so that the construction industry may have the truth regarding the comparative merits of clay and concrete brick.

WILLIAM CARVER,
Architect, Common Brick Manufacturers' Association of America.

Cleveland, Ohio, June 18.

Where Home-Use-Only Products Control Would Lead

Sir—Your editorial in the June 21 issue, entitled "Interstate Power Transmission," in which you comment on the West Virginia natural gas ruling of the United States Supreme Court, is both timely and interesting. The Maine idea of confining within the state the use of its natural resources is too selfish and misguided to find wide acceptance. If Maine should carry this principle to its logical conclusion and prohibit the export of that other great natural resource of hers, the potato, to say nothing of her timber, fish, etc., she would soon be in a bad way! In the case of New York State, it is significant that Governor Smith reverses his position on the question of the export of electric energy.

The United States Supreme Court in this ruling in the West Virginia case merely confirms a prior ruling in the West *v.* Kansas Natural Gas Co. (221 U. S. 229,255) case of a few years ago. The State of Oklahoma undertook by statute to prevent the piping of natural gas out of the state. The Supreme Court decided that no state has the power to prohibit the sale or shipment of its products to other states. Justice McKenna said in part as follows: "If the states have such power a singular situation might result. Pennsylvania might keep its coal, the Northwest its timber, the mining states their minerals. And why may not the products of the field be brought within the principles? To what consequences does such power tend? If one state has it, all states have it; embargo may be retaliated by embargo; commerce halted at state lines."

So long as our Supreme Court has the clarity of thought and breadth of vision indicated in these two decisions, the country has little to fear from the thoughtless and the radical.

E. A. VAN DUSEN.

Poughkeepsie, N. Y., June 22.

News of the Week

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

Shandaken Tunnel to Be Put in Operation Jan. 1

Preparatory to putting into use January 1, 1924, the Shandaken Tunnel, the Board of Water Supply of the City of New York will soon advertise a contract for clearing of the Schoharie Reservoir which contract also includes construction of a rock-filed timber crib dam which will serve to divert water into the tunnel. Most of the clearing will be done during the season of 1924. Contractors who are interested in the work may obtain preliminary information at the office of the Board of Water Supply, Municipal Building, New York City.

Feiker Enters Consulting Field

F. M. Feiker, formerly vice-president of the McGraw-Hill Company, Inc., and more recently on leave of absence as special agent to the Department of Commerce at Washington, will after his return from Washington, be associated with the staff of the Society for Electrical Development, 522 Fifth Ave., New York City. Mr. Feiker will be available to act as a special counselor to engineers, manufacturers, central stations, jobbers, contractor-dealers and publishers, for which his special training and wide knowledge in the engineering publishing and public relations fields of many industries well qualify him. Mr. Feiker will retain a consulting relation to the McGraw-Hill Co., Inc., and he will continue in a similar capacity his relations to the problems of personnel and organization of the Department of Commerce at Washington.

Howard B. Gill Leaves A.G.C.

Howard B. Gill, who for the past four years has been connected with the Associated General Contractors of America, first as assistant secretary and then for three years as publication manager, is soon to leave the Association and become publicity and financial secretary of the National Council for Prevention of War. Mr. Gill became assistant secretary in May, 1918, having been first secured to take charge of and publish the proceedings of the organization meeting of the A.G.C. in Chicago in November of 1918. Mr. Gill organized the committee in research work of the association and established the monthly magazine now known as the *Constructor*. He also established the statistical service published in *Index*.

The National Council for Prevention of War, with which Mr. Gill becomes associated, is a federation of thirty-six national organizations, including the National Board of Farm Organizations, National Education Association, National Consumers' League, etc. Its officers and executive board include President Lowell, of Harvard, Jane Addams, Will Irwin, William Allen White, President Hibben, of Princeton, and other publicists and leaders in national life.

Two-Car Elevated Train Plunges 30 Ft. to Street in Brooklyn; Seven Persons Killed

Rear Truck on Second Car Becomes Derailed on Tangent Track; Two Score Injured; Wooden Car Bodies Built in 1898

Seven persons were killed and more than two-score injured, some of them seriously, when a two-car train of the Brooklyn-Manhattan Transit Co., on its way from Bay Ridge to Manhattan, became derailed near the Atlantic Ave. station in Brooklyn, New York, and fell from the elevated structure to the pavement about 30 ft. below. Just what caused the derailment is now the subject of a series of investigations being undertaken by the transit company and the Department of Plants and Structures, of this city. The accident occurred about two o'clock the afternoon of June 25, and about 60 to 70 passengers occupied the two cars.

An examination of the track where the accident occurred seemed to indicate that the rear truck of the rear car was the first to derail, an assumption borne out by a statement issued late on the day of the accident by W. S. Menden, president of the newly reorganized company, which changed its corporate name but a few weeks ago from the Brooklyn Rapid Transit Co. The first indications of derailment were noticeable at the heel of the frog. The train was trailing a cross-over switch located about half way between a curve and the Atlantic Ave. station, on a stretch of tangent track roughly estimated as 500 ft. long.

Condition of Frog

The heel of the frog showed slight abrasions. The fishplate which connected the wing guard rail to the frog casting was loose, there being a play of about an inch in this wing across the ties. The first indications of cutting by the wheel flange on the ties was immediately in front of the frog. This cutting of the ties continued up and across the ties until, at a distance about 10 ft. beyond the point of switch, the rear truck apparently became detached from the body of the car. This rear truck, according to the statement of Mr. Menden, was the one that remained on the elevated structure, all the others being carried to the street below. A thorough examination is to be made of this truck to determine if there was any structural weakness that might have contributed to the derailment.

The cars, when they fell, were badly splintered, and considering the age of the rolling stock, it is remarkable that there was not greater loss of life. The cars were built by the Pullman Co. in 1898, and were first used when the elevated line was a steam road. When the line was electrified (the electrification beginning in 1898) new trucks replaced the old ones.

A number of investigations into the cause of the accident are being carried

(*Continued on p.* 1141)

Menden Issues Statement

A statement was issued by W. S. Menden, president of the Brooklyn-Manhattan Transit Co. several hours after the accident, and after he had personally looked over the track and wreckage. This statement follows:

Mr. Menden, president, stated late this evening (June 25) that the investigation of cause of the accident this afternoon, while not complete, indicates that the rear truck of the rear car of the two-car train was derailed, for some cause not yet ascertained, at the frog of the switch just east of the Atlantic Ave. station, causing the rear car to be precipitated into the street, dragging the forward truck of the rear car and the entire forward car, with its trucks, into the street, leaving the truck which was first derailed on the structure practically at right angles to the running rail.

"The track and switches at the location in question had been inspected in the morning and found in good condition. Both cars of the train had been inspected June 15, 1923, in accordance with the established practice and found O.K. The two cars in the train had been operated on the same line over the same switch and frog for nine trips on the same day without any difficulty of any kind. The train was in charge of an experienced motorman with a good record.

"The investigation is being continued in co-operation with public authorities to ascertain more definitely the cause of the derailment."

Am. Soc. C. E. Takes Prompt Action on Ousting of Arthur P. Davis

Steps to investigate the ousting of Arthur P. Davis from the position of director of the U. S. Reclamation Service were taken by the Executive Committee of the American Society of Civil Engineers on June 25. A special investigating committee is being formed. Meanwhile data for the committee is being gathered. Ex-director Davis and Secretary Work have been requested to submit statements of their respective sides of the case and telegrams have been sent to engineers in the West asking for facts and opinions on the subject. It is hoped that the investigating committee will be able to report to the Board of Direction July 9, at the summer meeting of the society at Chicago.

Davis Removal Part of General Upheaval

Reported in Washington that Engineers Will Be Replaced in all Projects By Business Men

Following the removal of Arthur P. Davis as director of the United States Reclamation Service last week, there have been a number of reports in Washington regarding the future policy of the Interior Department in the conduct of the Reclamation Service. Secretary Work, of the Department of Interior, is in the West at the present time and has refused to give out any definite interview. However, other officials of the department, who may not be quoted, are responsible for statements of the intentions in the department.

In the first place, it may be said that Director Davis resigned at the request of the secretary, who gave no other reason than that he proposed to put this branch of the Interior Department on a business basis. Mr. Davis thereupon demanded a hearing under the civil service regulations, but he was informed by the secretary that such a hearing was not necessary because he had not been removed from office, but rather the office had been abolished. By abolishing the old title of director and giving the incoming head of the service the name of Commissioner of Reclamation, it becomes unnecessary for the secretary to give a statement in writing to the dismissed director as to why he was discharged from the service.

Other Substitutions Possible

It is understood further that Secretary Work plans to carry his reorganization of the service to the point where he will substitute business men for the technically trained project managers on the irrigation works in the West. The reason for this move, together with the inside explanation of why Mr. Davis was removed, is not officially available. The following statement, however, may be accepted as a fair picture of the views of Dr. Work, the Secretary of the Interior:

"In the natural evolution of the Reclamation Service, the engineering problems are being subordinated to the business policy of making a commercial success of the farms embraced in reclaimed areas. The engineering problems now are such that they can be handled by the chief engineer of the service. The crying need of reclamation is to devise means whereby the individual farmers can make reasonable profits. Under present conditions, their earnings are inadequate. They cannot pay even the water charges. Drastic steps must be taken if the overhead is to be cut down and the great commercial problem of making their farms pay solved. The West believes the farming of these reclaimed lands is economically sound. Under proper direction, the farmers' deficits can be changed into profits.

"Governor Davis, the new commissioner, is believed to be the type of man who can accomplish that purpose. His long association with the farmers' problems on reclamation projects and the fact that he has been the president for several years of the Western States Reclamation Association, fit him for the task of solving the business problems of the reclamation farmer. In that connection it was pointed out that Governor Davis would delegate all engineering matters to W. E. Weymouth, the chief engineer of the service, who has the confidence of all water-users. Secretary Work, however, recognized the value to the service of the dismissed director and tendered him employment at $20 a day to act as consulting engineer of the service. This Mr. Davis declined.

"In addition to the principle involved in making the change, there also was the matter of Mr. Davis' personality. He had served under several secretaries and had come to regard the job as his own. He was in many cases arbitrary and frequently insisted on having his own way. At times he insisted on following his judgment rather than that of the Secretary of the Interior. This led to serious trouble between him and Secretaries Lane and Fall. He is that type of capable man who refuses to play the game and who makes team work impossible."

It may be further stated that Retiring Director Davis did not feel at liberty to leave the Reclamation Service of his own motion. He frequently has declined offers which carried with them much higher salaries. With legislation finally on the statute books, which if carried into effect carefully, would mean the full reclamation of the West, it has been his avowed purpose to stay in the path of those who would repudiate reclamation obligations and of those who would dilute the fund by overloading it with new projects. In both of these stands, he has had the consistent support of the conservative business element in the West. The fact that Mr. Davis has been dismissed does not remove him entirely from that path. He expects to find means whereby he can continue to be a thorn in the side of those who threaten the ultimate success of the whole conception by catering to the selfish desires of those who would attach more importance to immediate personal advantages than to the future of reclamation as a whole.

Col. Sawyer New A.G.C. Secretary

Col. D. H. Sawyer has been appointed secretary of the Associated General Contractors of America effective July 1, according to announcement by Gen. R. C. Marshall, Jr., manager of the Association. He will succeed Eugene Young, who recently resigned the office to enter private business in Minneapolis. While the appointment is not formally effective until July 1, Col. Sawyer is already at the Washington headquarters of the A.G.C. familiarizing himself with the details of the office.

Col. Sawyer is a native of Illinois and a graduate of the engineering college of the University of Illinois. He has had wide experience as a constructor and as an engineer. For several years he was chief engineer of the Illinois Traction System. Later, he became a member of Sawyer Bros., consulting engineers, with offices in Seattle and Spokane.

When the United States entered the World War, Col. Sawyer joined the Construction Division of the War Department, being commissioned a colonel. Camp Brant and Camp Bragg were constructed under his direction, as was the nitrate plant at Cincinnati.

Western Society Holds Annual Meeting

Engineers Seen as Treasury Watchdogs, Public Protectors, Financiers and Practical Men—Society's Work

The engineer's relations to financial affairs were presented in two different aspects by two addresses at the fifty-third annual meeting and dinner of the Western Society of Engineers, held at Chicago on June 18. His relation to authorizations for and construction and maintenance of public improvement work was the main feature of the address of the incoming president, Charles A. Morse. He urged that the Society take an active part in public affairs not merely to inform the membership, but more especially to keep the general public informed before it authorizes expenditures on improvements, and to support the public official who is trying to run his department economically.

Closer understanding between the engineer and the banker in regard to private investments were advocated by E. Hill Leith, of Halsey, Stuart & Co., who emphasized the fact that the engineer must rely on the banker to handle securities which provide funds for his enterprises, and the banker must rely upon the engineer to safeguard his construction investments.

Opportunities and responsibilities of the engineer in the development of the future "greater Chicago" were visualized in the address of J. L. Hecht, retiring president, who stressed the point that in the development of a great and connected residential and industrial district, composed of many separate communities whose public work and services are, however, part of a comprehensive plan, the problems are those which must be prosecuted under the direction of competent engineers.

Washington Award Made

Presentation of the Washington Award to Captain Robert W. Hunt was the prominent feature of the meeting. This presentation was made by W. L. Abbott, who reviewed Captain Hunt's close connection with the development of the iron and steel industry of the United States since, at the age of 21, he threw in his fortune with the old Cambria Iron Works. His life's work in this direction, his liberal assistance in establishing and aiding the work of engineering societies, the efficiency and engineering skill of the business enterprise which he established, as well as his personal attainments and character were all considered in selecting him as the recipient of the award for 1922.

In reviewing the year's work, Mr. Hecht pointed out that there was a balance of $828 instead of last year's deficit of $1,574. Nine members have been lost by death and there is a net membership of 1,997, not including a number who are expected to be reinstated on payment of back dues. During the year thirty-seven meetings were held, with an average attendance of 172. Among the committees, notable work has been done by the committee on public affairs.

Officers for the year were announced as follows: President, Charles A. Morse, chief engineer of the Chicago, Rock Island & Pacific Ry.; vice-presidents, E. T. Howson, Horace Carpenter, H. H. Clark; treasurer, Geo. W. Hand; secretary, Edgar S. Nethercut.

Engineering Educators Meet at Ithaca

"Training for Leadership" Keynote of Papers—Comprehensive Survey Probable

One of the most successful meetings of the Society for the Promotion of Engineering Education was held at the College of Engineering of Cornell University, in Ithaca, N. Y., from June 20 to 23. Nearly 300 members and guests were in attendance, fully two-thirds of whom came from out of town. The outstanding feature of the meeting was a series of papers all grouped under the general head, "Training for Leadership." In addition, there were the usual committee reports, special conferences of the deans, the teachers of English, the drawing teachers, etc., and a thought-provoking suggestion as to improvement in the theory of engineering courses by Prof. Edwin Bennett, of the University of Wisconsin.

Progress was reported in the work of the so-called development committee appointed last year to formulate an answer to the question, "What can the society do in a comprehensive way to develop, broaden and enrich engineering education?" It has had a number of meetings and has succeeded in interesting several of the large foundations, notably the Carnegie Corporation, in a comprehensive study of engineering education. The Carnegie Corporation board is yet to meet, but Dr. Pritchett, its head, thinks the prospect of some funds being awarded the study distinctly favorable. This study is to be carried on under the direction of the society with a paid director and is to be distinct from some previous studies in that each one of the engineering schools is expected to make an exhaustive investigation of its own curriculum and administration as a preliminary to the work of the general inquiry. In a letter to Dr. Pritchett, it is stated that "It is proposed that the investigations of the society be directed to a study of the objects of engineering education and the fitness of the present-day curriculum for preparing a study for his profession. It will study the process by which the curriculum of fifty years ago has come to its present form; it will seek to set forth the nature and the weakness of the curriculum as at present administered; and it will indicate such modifications or developments as would seem to make for a sound, well balanced and fruitful course of study for engineering students."

Kimball Opens Discussion

Dean D. S. Kimball, of Cornell University, opened the discussion on "Training for Leadership." He outlined the development of the industrial control of the world and said that the engineer unquestionably is soon to be in command of industry, and therefore promises to be in control of the world. Certainly, the problem of leadership is now up to him. The engineer has the scientific method common to all science, but adds to it its application to human problems. It is, therefore, first necessary in engineering education not to weaken the curriculum in its instruction in the scientific methods of approach, for it is on that basis the engineer must take his lead. He would substitute for the word "engineer" possibly the term "industrially intelligent group" in any discussion of the engineer's prospective leadership. He said that the future lies either in the hands of the engineer or the business man, but the business man will have to know more about industry and have a broader vision toward the universal wellbeing if he hopes to become the future leader, taking the place of the present lawyer as the leader. He said that while the engineer has many virtues, he has the weaknesses of not being sufficiently broadly trained, that he is a cave dweller, not interested in people or things, that he lacks economic knowledge. When the engineer learns who he is, where he came from, and what his civilization stands for, he will be better trained.

Dean Kimball was followed at subsequent meetings by T. H. MacDonald, of the Bureau of Public Roads, who discussed "The Engineer as a Leader in Public Service," E. H. Lee, of the Chicago & Northern Indiana Railroad Co., on "The Engineer as a Leader in Transportation," Oliver S. Lyford, of the National Industrial Conference Board, on "The Engineer as a Leader in Industry," and W. E. Wickenden, assistant vice-president of the American Telephone & Telegraph Co., on "The Engineer as a Leader in Business." All of these speakers emphasized again and again the necessity of teaching fundamentals in engineering education, but this became so frequent in all of the discussions through the sessions that its force was somewhat weakened because there seemed to be no possibility of uniting on what fundamentals were, although the National Industrial Conference Board has defined them in some detail.

So far as the engineer's leadership in business is concerned, Mr. Wickenden did not speak very hopefully. He said that business was distinct from industry in that industry was productive and business distributive and commercial, and that the principles underlying business are not necessarily those underlying industry, involving as they do very much more of the element of risk, which is not common to the engineering type of mind. He felt, however, there was no reason why engineering instruction should be modified to fit business, and that there was no advantage either to the business man or to the engineer in insisting on such a joining together.

The paper by Professor Bennett of Wisconsin, entitled "Engineering Courses for the Functional rather than the Industrial Divisions of Engineering," pointed out that the functional divisions of engineering might be set up as research, design, supervision, management, and sale, whereas the industrial divisions as now established are roughly civil, mining and metallurgical, mechanical, electrical, chemical, and administrative. It is on the basis of these industrial divisions that engineering courses are now divided. He feels that a better division would be along the lines of functional divisions, especially as it may be possible in time to discover early in the student's career his special aptitudes toward the functional branches, a thing that cannot be discovered early as regards the industrial branches. Professor Bennett's suggestion, therefore, for an improved course involves not only the division along functional lines but a more intensive study of the student's early aptitudes with faculty counsel to direct the students into the line toward which his aptitude points.

His suggestion was not received with any tremendous enthusiasm by the professors present, though Prof. D. C. Jackson, of the Massachusetts Institute of Technology, said that in a way the scheme had been applied in the institution in the last two years, particularly in the increased choice of electives in those years. Dean O. M. Leland, of the University of Minnesota, contended that the interest of the boy himself in picking his course is one of the most important elements in his training and that the functional division is not so important to the student. He does not ask himself whether he is going to be a salesman or a manager or a research man, but he does say am I going to be an electrical engineer, a civil engineer, etc.? His functional choice comes later. Dean Leland, therefore, contended that it is very much more difficult to set up the functional division than the industrial one.

Five-Year Course

In the conference of the deans there was considerable discussion of the five-year prescribed course in engineering, but no conclusion was reached. Dean W. G. Raymond, of the University of Iowa, submitted a diagram of the five-year course which had been developed in his institution and which had been adopted by the faculty and has been referred to the president and governing board. It permits the degree of B.S. at the end of four years and of a professional degree in engineering at the end of five years, but most of the specialized engineering comes in the fifth year. A somewhat similar course was shown by Dean Cooley, of the University of Michigan. His course had been prepared by a committee and had been laid on the table by the faculty so that it is not in prospect of early adoption.

P. F. Walker, dean of the College of Engineering, University of Kansas, was elected president for the ensuing year, and F. L. Bishop, dean of the College of Engineering, University of Pittsburgh, secretary.

Harding Succeeds Isaacs as S. P. Consultant

Carroll R. Harding, who since 1916 has been assistant consulting engineer of the Southern Pacific Ry., on June 1, 1923, upon the retirement of John D. Isaacs, was appointed to succeed Mr. Isaacs as consulting engineer of the southern Pacific Ry. Mr. Harding was born at Hallowell, Maine, in 1888, and graduated from Cornell University with the degree of civil engineer in 1910. For three years he was employed by the American Bridge Co. and on surveys in Alaska, Michigan, and Costa Rica. He entered service with the Southern Pacific Ry. in 1913, and has been successively draftsman in the office of John D. Isaacs, chief draftsman in the same office, and assistant consulting engineer. He is president of the Cornell Society of Engineers, and is a member of the American Society of Civil Engineers and of the American Railway Engineering Association.

Elevated Train Plunges 30 Ft., Killing Seven

(*Concluded from p. 1138*)

on by the Brooklyn Manhattan Transit Co. by the city and by the Transit Commission.

Edwin P. Parcell, the motorman of the train, who escaped with minor face lacerations, was arrested immediately after the accident and released later on bail of $1,000. He was held pending an investigation into the condition of the switch, which, it was first said, might have been tampered with. But as the train was trailing rather than facing the switch, the switch, except at the frog, seems to have had little to do with the accident.

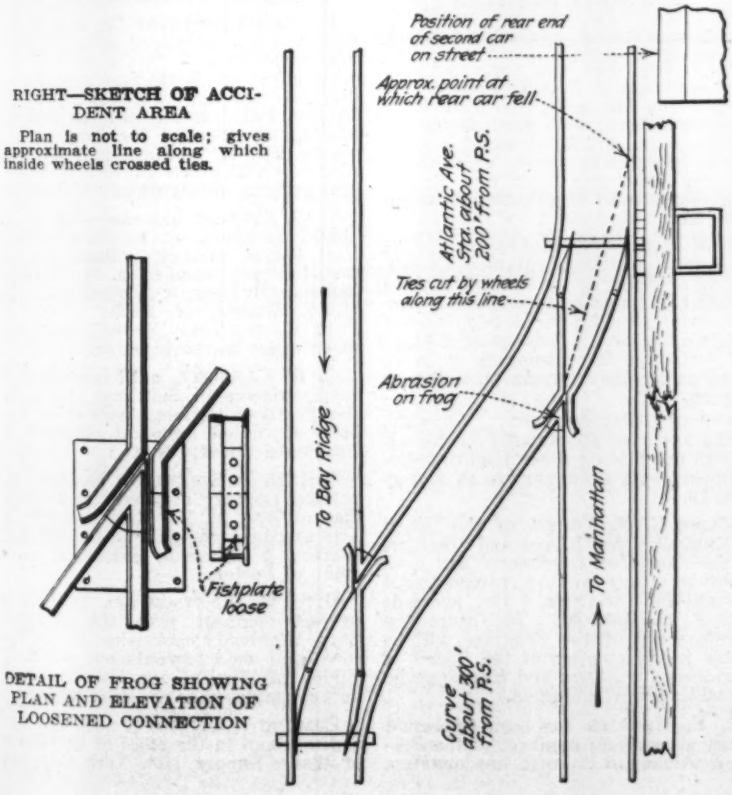
As the train fell from the elevated structure, one of the cars hit the front of a light delivery truck, but the driver jumped and thereby escaped injury. No other automobiles were struck, although Times Plaza, where the accident occurred, is one of the busiest of Brooklyn's centers of traffic. Traffic had been stopped in a direction oblique to the elevated structure axis.

TYPE OF ELEVATED STRUCTURE FROM WHICH TRAIN FELL

Immediately after the accident, when ambulances from almost a score of hospitals had cared for the injured, wrecking crews were put to work to clear the debris. Half a dozen oxyacetylene torches were operated most of the afternoon to burn the structural parts of the cars to sufficient size so that the wreckage could be handled.

RIGHT—SKETCH OF ACCIDENT AREA

Plan is not to scale; gives approximate line along which inside wheels crossed ties.


Position of rear end of second car on street
Approx. point at which rear car fell
Atlantic Ave. Sta. about 200' from P.S.
Ties cut by wheels along this line
Abrasion on frog
To Bay Ridge
To Manhattan
Fishplate loose
Curve about 300' from P.S.

DETAIL OF FROG SHOWING PLAN AND ELEVATION OF LOOSENED CONNECTION

Random Lines

Still Another Brand

A new novel, a newspaper blurb says, is "one of the finest pieces of imaginative engineering in many, many moons."

* * *

Down in North Carolina there is a city engineer who says that there's not a lot or block corner stake in town. "The only monuments are those at the town limits and in the cemetery."

* * *

Why Rail Transportation Lags

Kansas has, or had, a law which ordered that "when two trains approach each other at a crossing they shall both come to a full stop, and neither shall start up again until the other has gone."

* * *

Out West the other day the President said he would rather be an engineer than anything else in the world. He has ample precedent. Most public men would rather be than see one—especially in any kind of authority.

* * *

Publicity has at last got the better of Tom Edison. The newspapers have found out that one of his sons has just graduated from Boston Tech, and they are trying to get him to reconcile his practice with his press-agent's stories about the worthlessness of college men. This isn't the first of the Edison boys to get an engineering degree, but the Old Man has hitherto managed to keep it out of the papers.

* * *

Hot Weather Note

"It is reported," translated Florio from old Michel, Lord of Montaigne, "that in ancient times they made no fire in their houses, but without and at the foote of them: Whence by tonnels, which were convaide through their thickest wals, and contrived neere and about all such places as they would have warmed; so that the heat was convaied into every part of the house." But he does not report the price of coal or whether father did the stoking.

* * *

A South African dispatch reports the discovery of a fossil human skull that competes in age with the Neuderthal and Piltdown relics of prehistoric man. We may well wonder what concerns occupied the contents of that cranium some 100,000 years ago. But it's a safe bet that one of them was "the effect of sea-water on concrete."

* * *

It's fine, of course, that inventive genius has found means to strengthen and amplify the voices of public speakers. Pity 'tis that no one has yet devised some contraption that will proportionately strengthen and amplify the thinking behind the voices.

Connecticut Water Pollution Bill Vetoed by Governor

A bill creating a commission to control water pollution in Connecticut was vetoed on June 21 by Charles A. Templeton, governor of that state. In its original form the bill was submitted to the Legislature by a stream pollution commission created by the Legislature of 1921. This commission was headed by C. M. Saville, chief engineer and manager, Hartford water-works, and had two other engineer-members, besides representatives of the manufacturing and oyster industries of the state. The original bill was supported by the State Chamber of Commerce and the State Manufacturers' Association and by individual manufacturers also. It is characterized by the governor as "a reasonable compromise between all interests" but it is reported that it was opposed by some manufacturers.

The governor states that the bill was put aside in the last days of the Legislature and in its place an unsatisfactory substitute was passed. The original bill distinctly mentioned public health and covered the discharges from municipal sewers as well as from individual manufacturing plants. The substitute omits all reference to public health and covers nothing but the discharge of wastes from manufacturing plants. The governor urges that although the state health laws fully protect waters used for drinking purposes, there is still need for legislation to protect the public health from sewage for other reasons, mentioning shell fish. He declares that "it is fully as important to purify the streams from sewage as to purify them from factory wastes."

A marked inequality in the application of the substitute bill to mill and factory owners is pointed out by the governor, who states that trade wastes discharged into the streams through city sewers would not be covered by the substitute bill, but that the proposed water commission would have full jurisdiction over trade wastes from all manufacturing plants having their own outlets direct into streams and that this would be a particular hardship upon manufacturing plants outside the cities, since such plants within cities generally discharge their wastes through the city sewerage systems. Another objection made by the governor to the substitute bill is that it eliminates the provision of the original bill for directing first operations against new manufacturing plants.

Two years ago the Connecticut Legislature failed to give support to an earlier commission on stream pollution, that had conducted some quite extensive investigations of the subject, and created the commission whose bill was emasculated by the 1923 Legislature and has just been vetoed by the governor. (See *Engineering News-Record*, Nov. 3 and 10, 1921, pp. 745 and 757.)

Civic Center Plan Approved for Pasadena

Voters of Pasadena, Calif. on June 7, by a plurality of more than 3 to 1, approved a $3,500,000 bond issue for acquiring land and constructing a city hall, a library and an auditorium. These buildings are to be arranged in a group as a civic center in accord with a plan proposed by the city planning commission.

Engineering Societies

Calendar

Annual Meetings

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York, Annual Convention, Chicago, July 11-13.

NEW ENGLAND WATER WORKS ASSOCIATION, Boston, Mass.; Annual Convention, Burlington, Vt., Sept. 18-21, 1923.

AMERICAN PUBLIC HEALTH ASSOCIATION, New York; Annual Meeting, Boston, Oct. 8-11.

The St. John, N. B., Branch of the Engineering Institute of Canada recently gave a banquet in honor of W. J. Francis, the newly elected president of the Engineering Institute of Canada, this being the first stop in the tour arranged for the new head of the society.

The New England Water Works Association's Nominating Committee announce nominations as follows for the year ending September, 1924, for president, David A. Heffernan, Milton, Mass.; for vice-presidents, Theodore L. Bristol, Ansonia, Conn., and Stephen M. Taylor, New Bedford, Mass.; and treasurer, Frederic I. Winslow, Framingham, Mass.

The Detroit Engineering Society at its meeting June 22 was addressed by the mayor of Detroit, Frank E. Doremus, on the engineer's duties and opportunities as citizens.

Personal Notes

W. J. KING has been appointed resident engineer of Kansas Federal Aid Project No. 149, under the state highway commission, with headquarters at Holton, Kan. Mr. King was for many years county engineer of Labette County, Kan., and later was Kansas representative of the Portland Cement Association.

G. F. NICHOLSON, chief engineer, Port of Seattle, has been retained as consulting engineer by the Port of Olympia (Wash.) Commission to prepare a comprehensive plan for the development of Olympia harbor. A bond issue of $450,000 for these improvements is to be voted on by the Olympia port district July 10.

AUBREY RIEBENNACHT, Lowville, N. Y., has been appointed junior engineer in the Illinois State Highway Department with headquarters at Effingham, Ill.

MAJOR G. R. YOUNG, of the Board of Engineers for Rivers and Harbors, of the Corps of Engineers, has been made secretary of the International Navigation Congress. He succeeds COL. J. C. SANFORD. In future the secretaryship of the Congress will be vested in the member of the Board of Engineers for Rivers and Harbors who is resident in Washington.

E. K. MENTZER has been appointed principal assistant engineer of the Boston & Albany R.R., with headquarters in South Station, Boston, succeeding G. W. Abbott, who is taking up private practice. W. A. BUMP is appointed division engineer of the Albany division with headquarters in Springfield, succeeding Mr. Mentzer in that position.

E. G. RAYNOR has been appointed highway engineer in the Bureau of Public Roads with headquarters at Pierre, S. D. Mr. Raynor has worked in the state highway departments of New York and Iowa and recently was assistant division engineer of the Nebraska State Department of Public Works. He served in France as captain of engineers.

GABRIEL HENRY, who has been consulting engineer of the department of roads of the province of Quebec, has been appointed chief engineer of the department, succeeding H. N. NECKER, who is to be connected with a road contracting firm at Sherbrooke.

C. C. CONGDON has been appointed city engineer for the city of LaCrosse, Wis., to succeed E. C. BLAKE, resigned.

DR. RICHARD BISHOP MOORE, chief chemist and mineral technologist of the U. S. Bureau of Mines, has resigned and has taken charge of the development department of the Dorr Co., engineers, with headquarters in their New York office. Dr. Moore's work at Washington has included general supervision of the chemistry research of the Bureau of Mines, and charge of the work in non-metallics, ceramics, rare metals, helium, and alloys. He built and operated the government radium plant at Denver and directed the construction and operation of three government helium plants during the World War. With the Dorr Co. Dr. Moore will have charge of research in the development of new processes in metallurgy and chemistry.

BRILLHART-BROTHERS CO. and F. H. CLEMENT CO. have been merged into a new corporation, F. H. CLEMENT & CO., with offices in Bethlehem and Philadelphia, Pa., and equipment yard at Bingen, Pa. The organization and operating personnel of the former companies will be retained, and the new company will solicit railroad and general building construction.

O. B. KERCHER has succeeded W. T. HORN, resigned, as engineer of the Fort Wayne district, Indiana, for the state highway commission. Mr. Kercher has recently been employed with the U. S. Bureau of Public Roads at Fort Worth, Tex. He will have 700 miles under his jurisdiction.

C. W. CAMPBELL, until recently field representative in Southern states for the Portland Cement Association, has been appointed assistant engineer of Buncombe County, N. C.

SAMUEL M. ELLSWORTH has been appointed sanitary engineer for the Village of Rye, N. Y. Until recently he was assistant engineer in the office of Weston & Sampson, consulting engineers of Boston.

OTTO W. KNUTSON has been made project engineer with the Missouri State Highway Commission, having entered that work from the office of R. E. Tilden, of Winnemucca, Nevada, where he was employed as assistant engineer.

EDMUND I. MITCHELL, until recently a draftsman in the office of the Board of Water Supply, New York City, has

joined the consulting engineering firm of Waldo S. Coulter, New York City. Mr. Mitchell is the engineer in charge of sewer construction at Spring Valley, N. Y.

WILLIAM J. KNAUER, former county engineer of Chautauqua County, New York, has become superintendent and junior partner of the general contracting firm of Hitchcock & Knauer, of Olcott, N. Y.

DANIEL C. COOPER has left the U. S. Gypsum Co., with which firm he was employed as superintendent of construction at Oakfield, N. Y., and has gone to Los Angeles, where he now becomes assistant engineer on harbor improvements with the harbor commission of that city.

ELIJAH H. OWEN, of Owen & Seabrook, Detroit, Mich., states that since the death of his associate Charles R. Seabrook, the firm has been dissolved and he has become associated with ALVA M. HULL in a new firm, Hull & Owen, architects and engineers, Detroit.

ALFRED L. VEZINA, recently associated with Matthew O'Brien, San Francisco architect, and formerly with the California state department of engineering and the Thompson-Starrett Co., has, with John Diestel, entered the contracting business in San Francisco with an office in the Russ Bldg.

L. B. REYNOLDS has been appointed professor in civil engineering at Stanford University, Palo Alto, succeeding Prof. C. D. Marx, who becomes emeritus professor.

D. B. STEINMAN has been retained as designing engineer for the Carquinez highway bridge across Carquinez Strait, Calif. CHARLES DERLETH, JR., of Berkeley, Calif., is chief engineer; and WILLIAM H. BURR, of New York, is consulting engineer. The main structure is to be 3,350 ft. long, including two cantilever spans of 1,100 ft. In addition there will be about 1,400 ft. of steel viaduct construction, making the total length of structure nearly one mile. The estimated cost is about $5,000,000. The plans and specifications will be prepared in Dr. Steinman's office in New York City. The bridge is being built by the Rodeo-Vallejo Ferry Co.

W. J. FORBES, director of Concrete Constructions, Ltd., designing and contracting engineer of Sydney, N.S.W., is in the United States studying highway design and construction and the erection of large buildings. After spending some time on the Pacific Coast and in the Middle West, he is now in New York.

R. K. WEST, chief engineer of the Central Board of Roads, Republic of Panama, is in the United States and has been spending time in New York and Washington on various business matters.

WILL P. BLAIR, vice-president, National Paving Brick Manufacturers Association, has returned from the International Road Congress at Seville, Spain. While abroad, he spent some time in detailed study of the highways of England and Scotland.

GEORGE MATTIS, former city engineer of Oakland, has become associated with the F. F. Porter Company of Oakland, Calif., real estate operators, as an industrial and consulting engineer.

E. E. CARPENTER, member of the firm of Baker & Carpenter, consulting and construction engineers of San Francisco, has been appointed chief engineer of the British Columbia Electric Ry. Co., Vancouver, B. C. The appointment was made effective immediately and Mr. Carpenter is already in Vancouver engaged in his new work.

LAZARUS WHITE, member of the firm of Spencer, White & Prentis, New York, foundation specialists, and for a number of years division and department engineer on the Catskill aqueduct, sailed from New York last week for a trip abroad. He will first visit London and then proceed to the continent returning some time in September.

CHARLES SHALTER KRICK, St. Davids, Pa., was given the degree of Doctor of Engineering at Lafayette College, June 11. Mr. Krick is general manager of the Eastern region of the Pennsylvania R.R.

F. G. SOMNER, for several years division engineer of the California State Highway Commission at Willits, Calif., has resigned and will be succeeded by THOMAS A. BEDFORD, who has been division engineer at Dunsmuir, Calif., and who will be succeeded in the Dunsmuir office by H. S. COMLY, previously assistant division engineer at that point.

T. HEES has been appointed district engineer, Canadian Pacific R.R., and is stationed at Calgary, Alberta.

C. F. PRICE, formerly of the engineering department of the California State Highway Commission, has been appointed city manager of San Mateo, Calif.

STEWART PURCELL has been appointed chief engineer of Baltimore, Md., succeeding August E. Christhilf, the appointment being effective July 1. Mr. Purcell was born in Ireland and is a civil engineering graduate of Cornell University. He was employed by the Pennsylvania R.R. for seven years and entered the employ of the city of Baltimore in 1901, where he has been structural engineer in the building inspector's department, assistant division engineer in the filtration division in charge of the construction of the Montebello filtration plant under the direction of J. W. Armstrong, designing engineer, and, more recently, connected with the city highway department.

JULIUS R. HALL, formerly principal assistant engineer of the Sanitary District of Chicago, has resumed practice as designing and consulting engineer at 115 So. Dearborn St., Chicago, and will specialize in the reports and estimates for public and industrial work.

WILLIAM HOOD, formerly chief engineer of the Southern Pacific Co., who retired two years ago after fifty-four years of service, received the degree of doctor of science June 18 from Dartmouth College, of which he was a graduate in 1867. Mr. Hood's part in the history of railroad construction is connected with scaling the Sierra Mountains, the Tehachapi Loop, lines across the Siskiyous, the Lucien Cutoff, and the line through the Carriso Gorge in Southern California which pierces solid granite seventeen times in 11 miles.

DR. EDWARD BARTOW, head of the Department of Chemistry, University of Iowa, was given the honorary degree of master of science at the commencement of Williams College, Williamstown, Mass., June 25. Dr. Bartow is a Williams man.

Obituary

J. A. MCCAMPBELL, of Philadelphia, died recently from heart trouble. Mr. McCampbell had been for seventeen years associated with Stone & Webster, Inc., and at the time of his death was superintendent of construction on the 90,000-kw. power house extension for the Philadelphia Electric Co. He had had charge of construction of many power plants for the company, including the 95,000-kw. steam station for the Buffalo General Electric Co.

W. A. DUCKER, for some years past connected with the Manitoba department of public works, died recently in Winnipeg at the age of 71 years. He was at one time in the service of the Canadian Pacific Ry. and was later appointed by the Dominion Government as swamp lands commissioner.

JOHN T. CHILD died recently at Albemarle, N. C., where he was resident engineer on a sewer and pavement project for the Gilbert C. White Co. of Durham, N. C. Mr. White was a graduate of Cornell University, had been assistant engineer on pavement and sewer construction in Illinois and Texas, was 35 years old, and had served seven years as engineer of the Rochester, N. Y., Bureau of Municipal Research.

E. C. STRACHAEUR, division construction superintendent of the California State Highway Commission, died at his office in Norman, Calif., June 9, aged 48 years.

PHILIP KIRSCHNER, contractor, Cleveland, Ohio, died recently at Johns Hopkins Hospital, Baltimore. Mr. Kirschner, who was 63 years old, had in twenty-five years of contracting in Cleveland built as many as two hundred of the city's schools.

WILLIAM G. ARMSTRONG, chief engineer of the St. Paul Union Depot, died June 12 in St. Paul, Minn. Mr. Armstrong went to St. Paul in 1915 to work on plans for the Union Depot. Those plans were adopted in 1917 and Mr. Armstrong has since then been in charge of construction of the Union Depot and the elevation of the tracks approaching it. The head-house is finished and the general project is about half completed. Before his death Mr. Armstrong gave to his assistant full details for the completion of the work. Mr. Armstrong was born in Iowa in 1859 and was a civil engineering graduate of Iowa State College. Two other outstanding works of his are the Boone viaduct across the Des Moines River on the Chicago & Northwestern R.R., one of the longest double-track structures of its kind when built, and the terminal of the Chicago & Northwestern R.R. in Chicago. He was a member of the American Society of Civil Engineers and of the Western Society of Engineers and had always taken an active part in society affairs.

From the Manufacturer's Point of View

A Point of Contact Between Maker and User of Construction Equipment and Materials

The Lubrication of Construction Equipment

Hints for the Contractor for Lengthening the Life and Improving the Operation of Excavating Machinery and Concrete Mixers

(From Information Supplied by The Texas Co., New York.)

IN the operation and maintenance of construction equipment proper lubrication offers to the contractor a means of counteracting the injurious effects of severe service and exposure of his machinery to all kinds of weather. If cylinders and bearings are to resist scoring, due to the entry of abrasive particles of foreign matter; if gears are to operate without abnormal wear in the presence of dust; and if wire rope and chains are to function safely, day after day, without broken or rusted strands or links, continued vigilance must be practiced in the selection and the regular application of lubricants.

Excavating Machinery

Steam Cylinders—Under the general classification of excavating machinery are normally included power shovels, ditching machines, dragline excavators, trenching and backfilling equipment and dredges of various types. The digging, handling and disposal of earth, gravel, sand, ore and other solid and semi-solid materials preparatory to construction work are among the most important operations which the contractor has to perform. In order to keep power shovels, dredges, trenching and back filling machines in continuous operation, it is essential to give careful attention to their lubrication at all times. Perhaps the most important detail is the lubrication of steam cylinders. In any of the above machines which are steam driven the existing conditions and methods of operation will be such that if any but a high-grade, properly compounded lubricant is used the cylinders will suffer accordingly.

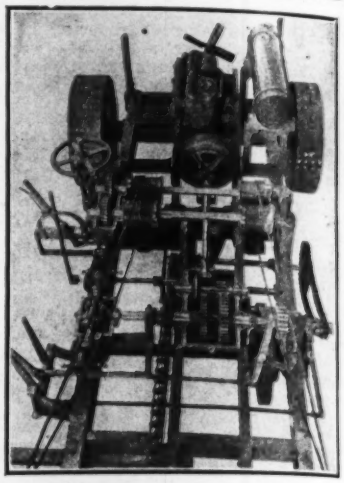
Steam used on such machines will, in general, be of comparatively low pressure (100 to 150 lb.) and will have quite a large moisture content. Although steam is taken from the highest part of the boiler it will frequently be relatively wet when it enters the header. Furthermore, line condensation and moisture content will be high between the boiler and engines, with a corresponding decrease in pressure, due to the fact that steam pipes are often not covered to any great extent, and the engines are frequently subject to intermittent operation. As a result there will almost always be an accumulation of water above the throttle valves, prior to starting the engines, depending in amount upon the length of time they have been stopped. If the cylinders are not covered with a tenacious film of properly compounded lubricant the admission of these slugs of water will tend to wash the lubricant from the wearing surfaces, and for the next few strokes insufficient lubrication will be possible and scoring and abnormal wear may occur. The constant repetition of this action produces compression losses and inefficient operation of the entire machine due to steam leakage past the piston rings. Groaning of the engines or rattling of the valves on their seats may also occur in extreme cases.

The problem, therefore, is to select and use a grade of cylinder oil which contains a sufficient amount of high-grade animal or fixed oil to promote the formation of an extremely tenacious film of emulsified lubricant, which will adequately resist the washing action of any water that may be present. The base of this lubricant should be a medium viscosity, highly adhesive, steam refined cylinder stock. For this purpose a comparatively high compound cylinder oil of about 130″ Saybolt viscosity at 210° F. has proved to be most satisfactory.

This article gives practical suggestions for the lubrication of:

Steam Cylinders
Crawler Traction
Journal Boxes
Engine Bearings
Gasoline Engines
Electric Motors
Gears
Chains and Wire Rope
Concrete Mixers
Roller Bearings

In order efficiently to lubricate such steam cylinders the oil should be delivered by a positive feed lubricator, preferably of the force feed type, via suitable atomizers. Hydrostatic lubricators could be used, were the engines to operate continually, but the usual intermittent service involved would either require constant closing and opening by the fireman or else a waste of oil would follow if the lubricator were left in service while the engines were stopped. The location of the oil pipes and atomizers in the steam lines is also important. These points should be approximately 6 ft. back from the throttle valves. In cases where a steam thrusting engine is located on the boom in certain types of these machines, the oil line often enters the steam pipe much further back from the throttle, with the result that in the event of steam leaks at the ball or swing joint there will be considerable loss of oil as well, with subsequent insufficient lubrication unless the leak is stopped.



MODERN CONSTRUCTION MACHINERY REQUIRES LUBRICATION OF MANY PARTS

General Lubrication—Where excavating machines are equipped with caterpillar tractors the lubrication of link-pins and rollers is important to insure against excessive friction losses and power consumption. Automatic lubrication is generally regarded as the most satisfactory, the lubricant being furnished from internal reservoirs located in the treads and rollers. For this service a relatively heavy pure mineral lubricant having a viscosity of about 200″ Saybolt at 210° F. will be most suitable.

On certain types of railroad shovels and other excavating machinery, journal boxes similar to those used in railway service will be installed on traction wheel journals. As a general rule these journals, although they are not subjected to the same high speeds and lengthy periods of operation as railroad journals, are lubricated in a similar manner, i.e., by packing the journal box with wool waste which has been saturated in mineral oil. For this purpose a 300″ to 500″ Saybolt viscosity (at 100° F.) pure mineral oil, as recommended for general bearing service hereafter, will be suitable.

The lubrication of other wearing parts on the average excavating machine can be well taken care of by means of a medium viscosity straight mineral oil or a high-grade compression cup grease. Many builders recommend grease lubrication and accordingly equip their machines with compression grease cups. Grease for this purpose should be free of acid or alkali and should contain no filler such as talc or asbestos, which tends to clog the oil grooves. External lubrication on excavating machinery, whatever its nature, is necessarily a difficult proposition, and enough dirt, dust and abrasive matter will work its way into the bearings, without the addition of any more in the form of improperly compounded greases.

When engine bearings, etc., are lubricated with oil, the viscosity of the latter should be in the neighborhood of 300 to 500″ Saybolt at 100° F. For electric motor bearings, however, in-

To Train Oxy-Acetylene Welders

The American Welding Society has just issued an outline of a course for the training of oxy-acetylene welders. This report was prepared by a committee and combines the experience of experts of the Federal Board of Vocational Education, the American Welding Society and the National Research Council. For the information of the person who is selecting candidates, the text includes a discussion of the qualifications which the candidates for training should possess. For the information of the instructor, the text includes the fundamentals in gas welding, together with a detailed statement of content, classified under type welding jobs arranged in the order of difficulty. Copies may be secured from the American Welding Society, 29 West 39th Street, New York City.

Construction Equipment Exported

Figures from the Department of Commerce indicate the following exports of construction equipment during April, 1923:

Ten steam and power shovels valued at $89,474 were shipped, five of them going to Canada and two to Australia. Eleven cranes, costing $101,494, were exported, Canada, with seven, again being the largest consumer. In the concrete mixer field 64 machines were sold for $66,951; 26 of these units went to Canada and 14 to Japan. During the month miscellaneous construction equipment not specifically classified totaled 462,831 lb., costing $88,760.

(*Continued from Page* 1144)

volving ring oiling systems, a lighter oil will be best, ranging from 180 to 200" viscosity. The method of applying engine oils is worthy of comment.

Hand oiling is frequently customary, but is not recommended due to the possibility of oil holes becoming clogged with dust and dirt, and the bearings suffering accordingly. It has been proved that sight-feed oil cups are probably the best equipment to use. They should at all times be so covered that the contents are kept free from contamination.

Internal Combustion Engines

Where excavating machinery, such as power shovels and trench machines, etc., is driven by kerosene or gasoline engines instead of steam, lubrication develops into a problem similar to that involved in the modern tractor or automobile. For such service the motor lubricant is of chief importance and should be given careful consideration. Usually some form of force feed lubricating system is involved which passes the oil through a hollow drilled crankshaft under sufficient pressure to reach all wearing parts. On gasoline engines a straight mineral motor oil of from 500 to 750" Saybolt viscosity at 100° F. will be suitable, the grade selected being dependent upon the weather and operating temperatures. For tractor type engines a somewhat heavier lubricant should be used, the viscosity of which varies from 70 to 110" Saybolt at 210° F.

(To Be Continued Next Week. Subjects: Lubrication of Gears, Wire Rope Chains and Concrete Mixers.)

Recommend Fewer Varieties of Hollow Building Tile

At a meeting held June 19, at the Department of Commerce, the Standards Committee of the Hollow Building Tile Association reported to the Department's Division of Simplified Practice, the results of a survey which the association had made of existing varieties in types, sizes, and weights of hollow building tile. The survey showed 36 different sizes—each made in a wide variety of weights. The committee recommended the elimination of 23 of the 36 sizes, and the retention of 13 as "standards" for the industry. A standard weight, with a permissible variation of 5 per cent over or under the standard weight, was also recommended for each of the 13 sizes retained.

The committee requested the Department of Commerce, through its Division of Simplified Practice, to call a general conference next October of manufacturers, architects, engineers, contractors, and builders to discuss the general adoption and use of the recommended standard sizes and weights.

Cargo Beam Patent Valid

The validity of the Lenke patent (No. 1,228,120) for cargo beams used in unloading material from the holds of vessels to wharves has been upheld by the United States Court of Claims in a decision rendered June 4 by Judge Booth in the case of the Richmond Screw Anchor Co., Inc., against the United States. Instead of being rigid, like previous types of construction, the Lenke cargo beam is so mounted as to "swing in response to the application of the load wherever it may be situated and presents its full inherent strength by adapting its position to the angle of the hoist without more than normal strain under any circumstances." The beam consists essentially of a pivoted I-beam weighing about 1,300 lb. as compared with the heavier channel and cover-plate type of construction weighing 3,300 lb. formerly used. The suit was based on the use of the Lenke cargo beam by the Quartermaster Corps at the army supply base in Brooklyn in 1918.

Cement Making Pictured in New Film

Much of the equipment involved in making cement is illustrated in a two-reel moving picture called "The Story of the Manufacture of Portland Cement," just released for general showing. Starting with views of one of the large cement plants, the film pictures in a non-technical way the essential steps in transforming raw materials into portland cement. From the moment that a blast breaks loose a cliff of limestone in the quarry to the time when the finished cement goes into storage in big concrete bins the process of manufacture is almost entirely mechanical.

In addition to straight photography, animated drawings have been inserted to make clear what occurs inside the grinding mills, what goes on within the white-hot interior of the huge kilns, and how the cement sacks, suspended upside down, are filled after they have been tied. This film can now be secured without charge by interested organizations through any office of the Portland Cement Association, or from association headquarters at 111 W. Washington St., Chicago.

Business Notes

Bond Co., Boston, has been appointed representative for the New England territory by the T. L. Smith Co., Milwaukee, to handle sales of concrete mixers, excavators and loaders.

Hunkins-Willis Lime & Cement Co., St. Louis, has opened a new yard and warehouse on Forsythe Boulevard, west of the Rock Island tracks.

Thomas O'Brien, who has been connected with John F. Allen Co., New York, as engineer and sales manager for the past twelve years has been made general manager. The company manufactures a line of portable pneumatic compression and hammer riveters.

Nugent Steel Castings Co., Chicago, is the new name adopted at a meeting of stockholders May 28 to supersede the Electric Steel Co. The officers of the organization include Charles Piez, president; W. J. Nugent, vice-president and general manager; Prentiss L. Coonley, treasurer; and C. A. MacDonald, secretary. The company began operations in its present plant in 1915 and is claimed to be one of the first foundries to use electric furnaces on a large scale in the production of steel castings.

Charles F. Hall has resigned his position with the Equipment Corp. of America and has organized the Acme Equipment Co., dealers in construction equipment, with headquarters in Pittsburgh.

A. O. Beauchemin, formerly consulting hydraulic engineer of Montreal, is now vice-president of the Layne-New York Co., a subsidiary of the Layne & Bowler Co., water supply contractors, Memphis, Tenn., located in New York City. Mr. Beauchemin is a graduate of McGill University, and was in business for himself for several years in Montreal. Later he entered the employ of Layne & Bowler Co. and was a sales engineer for this company approximately five years.

Standard Scale & Supply Corp., Pittsburgh, has purchased and is now operating under new management the business formerly conducted by the Standard Scale & Supply Co. The new corporation manufactures scales, concrete mixers, and contractors' equipment. It has branch offices in New York, Philadelphia, Cleveland and Chicago.

McWane Cast Iron Pipe Co., Birmingham, Ala., announces the opening of its southwestern sales offices in the Magnolia Building, Dallas, Texas. J. L. Hill, formerly of Birmingham, has been appointed southwestern district sales manager, and will have charge of sales of the company's McWane precalked-joint cast-iron pipe, in the very small sizes, in the states of Arkansas, Louisiana, Oklahoma, Texas, New Mexico and in Mexico.

Stanley P. Seward has been appointed advertising manager, the White Co., Cleveland, to succeed M. H. Newton.

ATLAS PORTLAND CEMENT CO. (of Kansas) has been incorporated to acquire the property of the Western States Portland Cement Co. at Independence, Kansas, which manufactured the Cowboy brand of cement.

Equipment and Materials

For Patching Concrete Floors

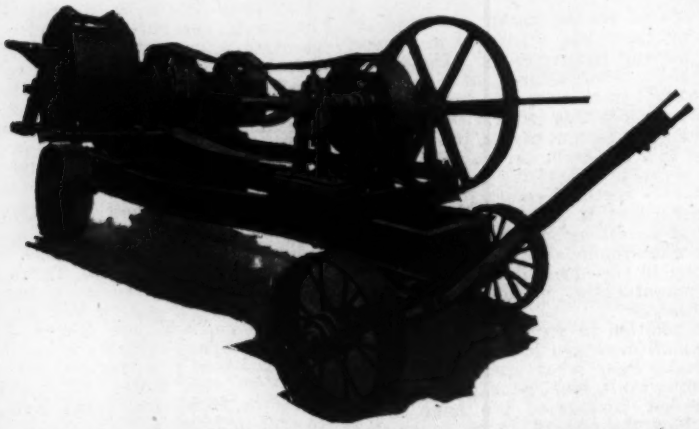
"Quickfix," a new compound for repairing concrete floors by producing a hard patch in 48 hours has recently been developed by the Master Builders Co., Cleveland. The installation of patches with this product, the company claims, can be made by any handy man, not necessarily skilled in the handling of concrete, by following directions furnished with the material. Interference with traffic is largely eliminated. Patches can be laid Saturday noon and put into use Monday morning. The cost of using the material for floor repair, according to the manufacturer's estimates, is less than 2c. a square foot.

Mounted Disc Crusher

To produce a well graded product for repairing macadam roads the Symons mounted disc crusher, illustrated herewith, was designed by Chalmers & Williams, Inc., Chicago Heights, Ill., to recrush 2½-in. gravel or stone to a size of from ½ to ¾ in., with a certain percentage of fine crushed rock and a small percentage of dust. One of the features of the equipment is its portability. It is mounted on a substantially built steel truck carrying countershaft, bearings and pulleys for driving the crusher mechanism.

It has been found in practice, the manufacturers report, that when the crusher is adjusted so that all of the product is reduced to pass a slot ½ in. in width, the capacity ranges from 10 to 15 tons per hour, depending upon the character of material being crushed and the method of feeding. Fifteen tons can be secured, crushing gravel or limestone, provided the feed does not contain any pieces over 2½ in. in diameter.

A 25-hp. motor is ample for driving crusher and countershaft, the



actual power requirements being from 18 to 20 hp., when under full load. The crushing faces are manganese steel and as they wear uniformly the same character of product is produced throughout the life of the crushing members.

Asphalt Heater for Mounting on Army Trailer

To utilize the supply of army trailers in the storage yards of state, county and city highway departments, Littleford Bros., Cincinnati, have designed a tar and asphalt heater expressly made for mounting on the Army spring-suspended chassis trailer and rubber-tired wheels. With this running gear a tar and asphalt heater can be trailed behind rapidly moving vehicles, enabling the highway department to cover more mileage. The equipment is known as the Trail-o-Heater.

The kettle of the heater has a capacity of 300 gal. All seams are

electric-welded. A 2-in. draw-off valve is provided on each side. The cover is arranged with a warming hood under which a barrel of tar or asphalt may be placed for draining. The furnace shell completely surrounds the kettle; it is supported on each side and is bolted to the chassis frame. It has a large fire-box with an improved type fire door, renewable grate bars, a large ash pit and draft control door.

Portable Triplex Pump for Road Builders

Designed especially for road builders' use to deliver water through long lines of small pipe a new triplex portable pump, powered by a four-cylinder, 15-hp. LeRoi gasoline engine, has been added to the line of contractors' equipment manufactured by the Domestic Engine & Pump Co., Shippensburg, Pa.

The pump will deliver from 46 to 60 gal. per minute against a gage pressure of 300 lb. per square inch. The complete unit is mounted on a steel-wheel

truck and is equipped with pole trees and neck yoke or tractor hitch.

The engine is equipped with radiator, cooling fan, magneto, governor, air filter, and is completely inclosed in metal housing. An air-circulating fan insures engine cooling. A friction clutch is provided between engine and pump, and a uniform speed is secured by a fly-ball governor.

Traction Wheel Mounting for 6-Yd. Railroad Shovel

Traction wheel mountings for its heaviest type of railroad steam shovel with 6-cu.yd. dipper, have been built and tested recently by the Osgood Co., Marion, Ohio. Previously this model of shovel had been mounted on standard railroad trucks for use in quarries and open mines where a considerable amount of blasting had to be done. The necessity of laying track and moving the shovel back and forth between blasts slowed down operations and decreased output.

To eliminate the track-laying opera-

tion giant traction wheels, 6 ft. in diameter and with faces of 36 in. on the front and 30 in. on the rear wheels, were designed. The front wheels are used as drivers and power is delivered through a series of gears from the hoisting engines on the shovel. Steering is accomplished from the cab by turning the rear wheels by means of a screw shaft and traveling nut.

In recent tests made in a large Pennsylvania stone quarry, the manufacturer reports, the shovel was moved a distance in one day that under old track-laying methods would have required at least ten days. The traction mountings are designed to facilitate the use of large railroad type steam shovels in solid-bottom quarries and mines by increasing mobility and eliminating the necessity of pit men and jack arms.

The advantage of traction wheels

over railroad trucks for large railroad type steam shovels, are thus summarized by the Osgood Co. Greater mobility of machine, elimination of pit crew, easier accessibility to face of excavation, elimination of tracks and reduction of side strains and racking to the machine in general. Traction wheels, it is claimed, are also much less complicated, simpler to operate and have a low upkeep cost.

The 6-yd. shovel on which the traction wheels are used has an overall length of 85 ft., a width of 20 ft. and a maximum height over the cab of 15 ft., while the boom extends to a height of 32 ft. This type of mounting also is available for the 5, 3½, 3, 2½ and 1½-yd. shovels.

Publications from the Construction Industry

Steel Gratings and Stair Treads—MITCHELL-TAPPEN CO., New York, devotes a new 24-p. illustrated catalog to its Mitco interlocked steel grating and stair treads. The interlocking feature involves a series of dovetailed slots on fixed centers in the bearing bars into which the lateral or transverse bars are forced under heavy pressure. The gratings are designed particularly for use in connection with subways and as flooring in industrial and power plants where ventilating openings must be provided. A slightly different design of grating is employed for a coal grizzly.

Rolling Doors—J. G. WILSON CORP., New York, illustrates and describes in detail, in a newly published 16-p. catalog, its vertical rolling doors of steel and wood and its new horizontal folding door adapted for use in piers, freight sheds, warehouses and factories. The latter type is spring counterbalanced and may be folded up overhead out of the way.

Sewer Construction Equipment—W. H. ANDERSON TOOL & SUPPLY CO., Detroit, lists and describes its line of sewer builders' tools and equipment in a recent 16-p. bulletin. The equipment includes trench braces, manhole steps, winches, clay cutting knives, mud boxes, sewer cars, plank pullers, and ground augers.

Excavating Equipment—PAWLING & HARNISCHFEGER CO., Milwaukee, has issued three new bulletins featuring trenching machinery and convertible crane and power shovel rigs.

Tractor Sub-Soiling—C. L. BEST TRACTOR CO. is distributing a 40-p. illustrated booklet entitled "Subbing the Soil," which explains the use of tractor-operated sub-soil plows and chisels. While intended primarily for the agricultural field, the method has an application in construction work as is exemplified by the use of five standard tractor-operated chisel plows in building the stadium for the University of California where the broken ground was later handled by wheel-scrapers. Also, on the Merced irrigation project, a multiple standard subsoil plow hauled by a Best tractor loosened material in the bottom of the canal so that it could be removed by four-horse scrapers.

Business Side of Construction

FACTS AND EVENTS THAT AFFECT COST AND VOLUME

N. Y. Bricklayers Win Strike for $12 Daily Wage

Bricklayers in New York City won their strike, which has been in progress since May 21, when the Mason Builders' Association last week agreed to demands for a basic wage of $1.50 an hour, or $12 a day for a period of two years. This represents an increase of $2 a day over the basic daily rate of $10, which has been in effect since 1920. During the strike it was estimated that from $150,000,000 to $200,000,000 worth of work was being held up.

The construction concerns hit by the strike were among the largest in the United States. They included the George A. Fuller Co., the Thompson-Starrett Co., Cauldwell and Wingate, Marc M. Eidlitz & Son, William Crawford, Hegeman-Harris Co., John Lowry, Jr., G. Richard Davis, James Stewart Co., Starrett & Co., Charles T. Willis, Inc., and Cunningham & Foley.

Among the large operations affected by the strike were the Federal Reserve Bank, Nassau and Liberty Sts., the new store of Saks & Co., Fifth Avenue and Fiftieth St.; the Cotton Exchange, the Home Insurance Co., Maiden Lane and William St.; the Standard Oil Building, and the Pershing Square Building.

Structural Steel Sales in May

The Department of Commerce announces May sales of fabricated structural steel, based on figures received by the Bureau of the Census in cooperation with the Structural Steel Society. Total sales of 130,929 tons were reported for May by firms with a capacity of 225,790 tons per month.

Tonnage booked each month by 175 identical firms, with a capacity of 229,575 tons per month, is shown below, together with the per cent of shop capacity represented by these bookings. For comparative purposes, the figures are also prorated to obtain an estimated total for the United States on a capacity of 250,000 tons per month.

1922	Actual Tonnage Booked	Per Cent of Capacity	Estimated Total Bookings
April	200,588	87	217,500
May	184,638	81	202,500
June	168,498	73	182,500
July	157,631	69	172,500
Aug.	156,011	68	170,000
Sept.	146,146	64	160,000
Oct.	132,450	58	145,000
Nov.	111,794	49	122,500
Dec.	138,024	60	150,000
1923			
Jan.	172,415	75	187,500
Feb.	183,938	80	200,000
March	218,997	95	237,500
April	184,884*	81	202,500
May	130,929**	58	145,000

* Reported by 166 firms with a capacity of 228,455 tons.

** Reported by 157 firms with a capacity of 225,790 tons.

Cement Production Gains

Statistics issued by the Department of the Interior and prepared under the direction of Ernest F. Burchard, of the U. S. Geological Survey, from reports received from producers, show the production of portland cement in the United States for May, 1923, to be 12,910,000 bbl., as compared with 11,359,000 bbl. for April of this year and 11,176,000 bbl. for May, 1922.

For the first quarter of this year production exceeded that for the same period in 1922 by 10,415 bbl., the figures being, respectively, 25,669,000 and 15,254,000 bbl. A steady gain in production is also indicated by the statistics for the first five months of this year when the output was 75,607,000 bbl. as compared with 50,927,000 bbl. for the same period of 1922.

May (1923) shipments were 14,257,000 bbl., an increase of 1,508,000 bbl. over shipments for the same month a year ago.

The accompanying table contains the figures in detail.

PRODUCTION, SHIPMENTS, AND STOCKS OF FINISHED PORTLAND CEMENT, 1922 AND 1923, IN BARRELS

Month	Production		Shipments		Stocks at end of Month	
	1922	1923	1922	1923	1922a	1923
January	(a) 4,291,000	7,704,000	(a) 2,931,000	5,419,000	13,316,000	(a) 11,470,000
February	4,278,000	8,085,000	3,285,000	5,963,000	14,142,000	(a) 13,502,000
March	6,685,000	9,880,000	7,002,000	10,326,000	13,848,000	(a) 13,045,000
First quarter	15,254,000	25,669,000	13,218,000	21,708,000	.....	.....
April	9,243,000	11,359,000	8,592,000	12,954,000	14,470,000	(a) 11,463,000
May	11,176,000	12,910,000	12,749,000	14,257,000	12,893,000	10,115,000

Weekly Freight Loadings Again Pass Million Mark

For the second time this year, according to the Car Service Division of the American Railway Association, loading of revenue freight exceeded the million mark during the week which ended on June 9, for which the total was 1,013,249 cars. The first time the million mark was exceeded was during the week of May 26 when the total was 1,014,029 cars.

Freight car loadings are the heaviest for this season of the year in the history of the railroads, and for the week of June 9 were only one-half of one per cent under the record week in history, which was that of Oct. 14, 1920, when the total was 1,018,539 cars.

Despite the record loadings car shortage which was reported at 12,978, had virtually disappeared for all classes of equipment. At the same time reports showed more than 41,000 surplus freight cars available for service whenever transportation conditions warranted.

From Jan. 1 to June 9, inclusive, 20,981,062 cars have been loaded with revenue freight, compared with 17,442,444 during the corresponding period last year, and 16,359,067 during the corresponding period in 1921.

The total for the week of June 9 exceeded the corresponding week last year by 177,041 cars, and the corresponding week in 1921 by 225,966 cars. It also exceeded by 81,208 cars the preceding week this year when freight loadings were curtailed by the observance of Memorial Day.

Large Contracts Let During Week

Among the week's announcements of contracts awarded in Construction News, pp. 379 to 393, are the following:

Telephone exchange, New York, N. Y., to Marc Eidlitz & Son, Inc., $11,250,000.

Office building, Chicago, Ill., to R. C. Wieboldt Co., $7,000,000.

Bank and office building, Chicago, Ill., to H. Erickson Co., $5,500,000.

Office building, New York, N. Y., to S. S. Roth & Bros., $5,000,000.

Turbo units for power plant, Detroit, Mich., to Westinghouse Electric & Mfg. Co., Pittsburgh, Pa., $1,254,000.

Grain elevator, Ft. Worth, Tex., to Southwestern Eng. Co., Springfield, Mo., $1,500,000.

Concrete arch, Detroit, Mich., to Lennane & McIlvenna, $663,285.

Bids Wanted on Big Jobs

Among the projects on which bids are either asked or will soon be called for, in Construction News, pp. 379 to 393, are the following:

Railways, Montreal, Que., Canada, for Canadian National R.R., $20,992,000.

Hospital, Nashville, Tenn., for Vanderbilt University, $2,000,000.

Industrial plant, Toledo, O., for Libby Owens Sheet Glass Co., $1,500,000.

Cement mill, Ft. Worth, Tex., for South West Portland Cement Co., El Paso, $1,500,000.

High School, Kansas City, Mo., for Board of Education, $1,400,000.

Factory and warehouse, Dallas, Tex., for Brown Cracker and Candy Co., $1,000,000.

Weekly Construction Market

THIS limited price list is published weekly for the purpose of giving current prices on the principal construction materials, and of noting important price changes on the less important materials. Moreover, only the chief cities are quoted.

Valuable suggestions on costs of work can be had by noting actual biddings as reported in our Construction News section.

The first issue of each month carries complete quotations for all construction materials and for the important cities. The last complete list will be found in the issue of June 7; the next, on July 5.

Steel Products:	New York	Atlanta	Dallas	Chicago	Minneapolis	Denver	San Francisco	Seattle	Montreal
Structural shapes, 100 lb.	$3.64	$4.30	$4.50	$3.40	$3.55	$4.20	$3.95	$4.10	$4.25
Structural rivets, 100 lb.	4.40	5.00	4.95	3.75	4.25	5.40	5.00	4.75	6.00
Reinforcing bars, ¾ in. up, 100 lb.	3.54	4.25	+3.80	3.32½	3.45	3.85	3.65	4.10	4.00
Steel pipe, black, 2½ to 6 in. lap, discount	44%	52%	45%	47%	53-5%	36%	35.2@47.6%	40%	32.76
Cast-iron pipe, 6 in. and over, ton	62.50@63.50	—53.00	63.00	60.20	60.50	69.00	+62.00	70.00	60.00
Concreting Material:									
Cement without bags, bbl	2.70@2.80	2.85	2.25	2.20	2.39	2.84	2.71	2.90	2.25
Gravel, ¾ in., cu.yd.	2.25	1.90	2.25	2.00	1.85	1.90	2.15	1.25	1.50
Sand, cu.yd.	1.25	1.24	1.95	2.00	1.25	1.00	1.50	1.25	1.25
Crushed stone, ¾ in., cu.yd.	1.75	2.00	2.50	2.00	2.25	3.50	2.15	3.00	1.90
Miscellaneous:									
Pine, 3x12 to 12x12, 20 ft. and under, M.ft.	64.00	42.00	+55.00	58.50	43.25	60.00	41.00	—31.00	90.00
Lime, finishing, hydrated, ton	18.20	23.50	—22.00	20.00	25.50	24.00	22.00	24.00	21.00
Lime common, lump, per bbl.	3.00@3.25	1.50	—2.35	1.50	1.50	2.70	1.75	2.80	10.00
Common brick, delivered, 1,000	23.50	14.00	+13.10	11.00	17@19	12.00	15.00	13.00	16.50
Hollow building tile, 4x12x12, per block	Not used	.109	.115	.1032	.0836	.065	....	.11	.115
Hollow partition tile 4x12x12, per block	.1573	.109	.115	.0825	....	.065	.108	.11	....
Linseed oil, raw, 5 bbl. lots, gal.	—1.13	—1.20	—1.35	1.29	1.29	1.39	1.24	.86	1.38
Common Labor:									
Common labor, union, hour	.75	.35	.....	.....	.....	.50@.55	.55	....	.....
Common labor, non-union, hour	.....	.30	.30@.50	.85	.55	.35@.50	.50	.50@.62½	.30@.35

Explanation of Prices—Prices are to contractors in carload lots unless other quantities are specified. Increases or decreases from previous quotations are indicated by + or — signs. For steel pipe, the prevailing discount from list price is given: 45-5% means a discount of 45 and 5 per cent. Charge is 15c. per 100 lb. for cutting reinforced steel into 2-ft. lengths or over.

New York quotations delivered, except sand, gravel and crushed stone, alongside dock; common lump lime, in 280-lb. bbl. net, and hydrated lime f.o.b. cars; tile "on trucks"; linseed oil and cast-iron pipe f.o.b.

Labor—Concrete laborers' rate, 90c.; building laborers (pick and shovel men) 75c. per hr.

Chicago quotes hydrated lime in 50-lb. bags; common lump lime per 180-lb. net. Lumber delivered on job.

Minneapolis quotes on fir instead of pine. Brick, sand and hollow tile delivered. Cement on cars. Gravel and crushed stone quoted at pit. We quote on brown lime per 180-lb. net; white is $1.80 for Kelly Island and $1.70 for Sheboygan. Common labor not organized.

Denver quotes on fir instead of pine. Cement "on tracks"; gravel and sand at pit; stone on cars; lime, brick, hollow tile and lumber on job. Tile price is at warehouse. Linseed oil, delivered, in iron bbl. Common lump lime per 180-lb. net.

Atlanta quotes sand, stone and gravel per ton instead of cu.yd. Common lump lime per 180-lb. net.

Dallas quotes lime per 180-lb. bbl. Steel, cement, cast-iron pipe and crushed stone f.o.b. cars, other materials delivered.

San Francisco quotes on Heath tile, size 5½ x 8 x 11½. Prices are all f.o.b. warehouses except C. I. pipe, which is mill price plus freight to railway depot at any terminal. Common lump lime per 180-lb. net. Lumber prices are to dealers in yards at San Francisco, for No. 1 fir common.

Seattle quotes on Douglas fir (delivered) instead of pine. Lump finishing lime per 180-lb. net. Hollow building tile delivered. Hydrated lime in paper sacks. Sand and gravel at bunkers.

Montreal quotes on pine lumber. Sand, stone, gravel and lump lime per ton. Cement, lime and tile are delivered; sand, gravel and stone on siding; brick f.o.b. plant; steel and pipe at warehouse. Hollow tile per ft. Cement price is in Canadian funds (the Canadian dollar stands at 97.62). Bag charge is 80c. per bbl. Discount of 10c. per bbl. for payment within 10 days from date of shipment. Steel pipe per 100 ft. net; 2½-in., $32.76; 6-in., $108.

Changes Since Last Week

Prices of finished steel products have continued fairly stable during the last two months. Reinforcing bars are still quoted at $2.40, with plates and shapes at $2.50 per 100 lb., f.o.b. mill. Heavy oil production is creating an increased demand for storage-tank plates. Considerable new business in plates and structurals developed during the last week despite the recent quiet tone to the structural market, brought about by the suspension of many projects.

Douglas fir lumber market shows a slight tendency to soften. Seattle reports a decline of $1 per M. ft. in structural sizes. Yellow pine, however, advanced $2 per M. ft. in Dallas, due to unusually heavy local demand.

Slight fluctuations appear in cast-iron pipe prices throughout the South and West. Seattle reports steel and cast-iron pipe holding at levels quoted but with continuing shortage, and shipments practically impossible to obtain.

Raw linseed oil declined 1c. in Dallas; 3c. in New York and 4c. per gal. in Atlanta, during week.

A formal agreement between the New York Mason Builders' Association and the bricklayers was signed Monday, May 25. The contract calls for a basic wage of $12 per day for two years. Hod carriers are also to receive $8 per day during the same period. Iron workers and cement and concrete laborers are on strike. The former for the forty-four-hour week and abolition of the open shop, and the latter for a wage advance of $1 per day.